



# BIG-IP® Link Controller Solutions Guide

version 4.3

MAN-0053-00



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## Product Version

This manual applies to version 4.3 of the BIG-IP® Link Controller.

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Glossary

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# Introduction

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- Getting started
- Using the Administrator Kit
- Learning more about the BIG-IP product family



## Getting started

Before you start installing the BIG-IP Link Controller, we recommend that you browse this guide to find the solution that most closely addresses your needs. Briefly review the basic configuration tasks and the few pieces of information, such as IP addresses and host names, that you should gather in preparation for completing the tasks.

Once you find your solution and gather the necessary network information, turn to the *Configuration Worksheet* and *Hardware Orientation* poster for hardware installation instructions, and then return to this guide to follow the steps for setting up your chosen solution.

## Choosing a configuration tool

The Link Controller offers both web-based and command line configuration tools, so that users can work in the environment with which they are most comfortable.

### The Setup utility

All users will use the Setup utility. This utility guides you through the initial system setup. You can run the Setup utility from the command line, or from a web browser. The Setup utility prompts you to enter basic system information including a root password and the IP addresses that will be assigned to VLANs. For more information, see Chapter 2 of this guide.

### The Configuration utility

The Configuration utility is a web-based application that you use to configure and monitor the setup on the Link Controller. Once you complete the installation instructions described in this guide, you can use the Configuration utility to perform the configuration steps necessary for your chosen load balancing solution. In the Configuration utility, you can also monitor current system performance, and download administrative tools such as the SNMP MIB or the SSH client. The Configuration utility is best viewed with the following browsers: Netscape Navigator® version 4.7, or Microsoft® Internet Explorer version 5.0 or later.

### The bigpipe and bigtop command line utilities

The **bigpipe**<sup>™</sup> utility is the command line counter-part to the Configuration utility. Using **bigpipe** commands, you can configure virtual servers, open ports to network traffic, and configure a wide variety of features. To monitor the Link Controller, you can use certain **bigpipe** commands, or you can use the **bigtop**<sup>™</sup> utility, which provides real-time system monitoring. You can use the command line utilities directly on the Link Controller console, or you can run commands using a remote shell, such as the SSH client (encrypted communications only), or a Telnet client (if you are restricted by

cryptography export laws). For detailed information about the command line syntax, see the Appendix A of the ***BIG-IP Link Controller Reference Guide***.

## Using the Administrator Kit

The Link Controller Administrator Kit provides all of the documentation you need to work with the BIG-IP Link Controller. The Link Controller includes the following printed documentation.

- ◆ **Hardware Orientation Poster**

This poster includes information about the Link Controller unit. It also contains important environmental warnings.

- ◆ **Configuration Worksheet**

This worksheet provides you with a place to plan the basic configuration for the Link Controller.

The Link Controller also includes a resource CD-ROM that provides the following guides, in PDF format. These guides are also available from the Welcome screen when you log in to the Configuration utility on the Link Controller.

- ◆ **BIG-IP Link Controller Solutions Guide**

This guide provides examples of common link load balancing solutions using the Link Controller. Before you begin installing the hardware, we recommend that you browse this guide to find the load balancing solution that works best for you.

- ◆ **BIG-IP Link Controller Reference Guide**

This guide provides detailed configuration information for the Link Controller. It also provides syntax information for **bigpipe** commands, other command line utilities, configuration files, system utilities, and monitoring and administration information.

## Stylistic conventions

To help you easily identify and understand important information, this section describes the stylistic conventions used in our documentation.

## Using the solution examples

All examples in this documentation use only non-routable IP addresses. When you set up the solutions we describe, you must use IP addresses suitable to your own network in place of our sample addresses.

## Identifying new terms

To help you identify sections where a term is defined, we show the term itself in bold italic text. For example, a ***virtual server*** is a specific combination of a virtual address and virtual port, associated with a content site that is managed by a Link Controller or other type of host server.

## Identifying references to objects, names, and commands

We apply bold text to a variety of items to help you easily pick them out of a block of text. These items include web addresses, IP addresses, utility names, and portions of commands, such as variables and keywords. For example, with the **bigpipe pool <pool\_name> show** command, you can specify a specific pool to show by specifying a pool name for the **<pool\_name>** variable.

## Identifying references to other documents

We use italic text to denote a reference to another document. In references where we provide the name of a book as well as a specific chapter or section in the book, we show the book name in bold, italic text, and the chapter/section name in italic text to help quickly differentiate the two. For example, you can find information about **bigpipe** commands in the ***BIG-IP Link Controller Reference Guide***, Appendix A, *bigpipe Command Reference*.

## Identifying command syntax

We show complete commands in bold Courier text. Note that we do not include the corresponding screen prompt, unless the command is shown in a figure that depicts an entire command line screen. For example, the following commands show the configuration of the specified pool name:

```
bigpipe pool <pool_name> show
```

or

```
b pool <pool_name> show
```

Table Intro.1 explains additional special conventions used in command line syntax.

Item in text	Description
\	Indicates that the command continues on the following line, and that users should type the entire command without typing a line break.
< >	Identifies a user-defined parameter. For example, if the command has <b>&lt;your name&gt;</b> , type in your name, but do not include the brackets.
	Separates parts of a command.
[ ]	Indicates that syntax inside the brackets is optional.
...	Indicates that you can type a series of items.

**Table Intro.1** *Command line syntax conventions*

## Finding additional help and technical support resources

You can find additional technical information about this product using the following resources:

◆ **Release notes**

Release notes for the current version of this product are available from the product web server home page, and are also available on the technical support site. The release notes contain the latest information for the current version, including a list of new features and enhancements, a list of fixes, and, in some cases, a list of known issues.

◆ **Online help**

You can find help online in three different locations:

- The web server on the product has PDF versions of the guides included in the Administrator Kit.
- The web-based Configuration utility has online help for each screen. Simply click the **Help** button.
- Individual **bigpipe** commands have online help, including command syntax and examples, in standard UNIX™ man page format. Simply type the command followed by the word **help**, and the Link Controller displays the syntax and usage associated with the command.

◆ **Third-party documentation for software add-ons**

The Welcome screen in the Configuration utility and the resource CD-ROM both contain online documentation for all third-party software, such as GateD.

◆ **Technical support through the World Wide Web**

The F5 Networks Technical Support web site, <http://tech.F5.com>, provides the latest technical notes, answers to frequently asked questions, updates for Administrator Kit guides (in PDF format), and the Ask F5 natural language question and answer engine. To access this site, you need to obtain a customer ID and a password from the F5 Help Desk.

## Learning more about the BIG-IP product family

The BIG-IP platform offers many different software systems. These systems can be stand-alone, or can run in redundant pairs, with the exception of the BIG-IP e-Commerce Controller, which is only available as a stand-alone system. You can easily upgrade from any special-purpose BIG-IP to the BIG-IP HA software, which supports all BIG-IP features.

◆ **The BIG-IP**

The BIG-IP HA, and HA+ software provides the full suite of local area load balancing functionality. The BIG-IP unit also has an optional 3-DNS software module which supports wide-area load balancing.

- ◆ **The BIG-IP e-Commerce Controller**

The BIG-IP e-Commerce Controller uses SSL acceleration technology to increase the speed and reliability of the secure connections that drive e-commerce sites.

- ◆ **The BIG-IP Link Controller**

The BIG-IP Link Controller uses metrics and thresholds to manage inbound and outbound traffic through multiple gateways (routers) and Internet Service Providers (ISPs).

- ◆ **The BIG-IP special purpose products**

The special purpose BIG-IP provides the ability to choose from three different BIG-IP feature sets. When you run the Setup utility, you specify one of three types:

- **The BIG-IP Load Balancer**

The BIG-IP Load Balancer provides basic load balancing features.

- **The BIG-IP FireGuard**

The BIG-IP FireGuard provides load balancing features that maximize the efficiency and performance of a group of firewalls.

- **The BIG-IP Cache Controller**

The BIG-IP Cache Controller uses content-aware traffic direction to maximize the efficiency and performance of a group of cache servers.





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## Introducing the Link Controller

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- What is the BIG-IP Link Controller?



## What is the BIG-IP Link Controller?

The BIG-IP Link Controller is a dedicated IP Application Switch that manages bi-directional traffic to a site across multiple links, regardless of connection type or provider. The Link Controller provides granular traffic control for Internet gateways, so that users can define how traffic is distributed across their links in a way that meets their business priorities. The Link Controller transparently monitors the availability and health of links to optimally direct traffic across the best available link.

The Link Controller includes the following features:

- ◆ Dynamic load balancing, based on the following link attributes:
  - Total available bandwidth of the link
  - The costs of purchased incremental bandwidth segments
  - Inbound link capacity and resource limits
  - Outbound link capacity and resource limits
- ◆ Router monitoring, to ensure high availability and continuous uptime
- ◆ Internet Link Evaluator, to view current Internet connectivity metrics

## Understanding link load balancing

**Link load balancing** is defined as managing traffic across multiple Internet or WAN gateways. Link load balancing ensures high availability in the network, and enhances the performance of a web site or data center. Link load balancing provides a method by which an organization can reliably manage a multi-homed network. A **multi-homed network** is composed of one or more data centers that have more than one gateway, or link, to the Internet.

As enterprises increase their reliance on the Internet for delivering mission-critical applications and services, using only one link and ISP provider to access the public network represents a single point of failure. Link Load balancing, with the BIG-IP Link Controller, removes the risk of this single point of failure by enabling enterprises to control and monitor multiple links for their Internet connectivity.

The BIG-IP Link Controller:

- Guarantees reliable network connections and eliminates downtime by detecting any type of connection outage and transparently directing traffic away from malfunctioning or unavailable links.
- Distributes traffic to optimize the capacity of each connection by monitoring line throughput so that links do not become over-saturated.
- Increases user and site performance. The BIG-IP Link Controller measures and directs users over the best performing link to increase end user and site response times.

- Directs traffic over the least expensive link. Administrators can define the price of links and tiered pricing schemes. The BIG-IP Link Controller can direct traffic to the least expensive connection, lowering bandwidth costs.
- Traffic control to match business priorities. Organizations can define traffic policies to direct traffic over specified connections.
- Provides the Internet Link Evaluator, so that you can evaluate link performance, over time, to help you choose the Internet service providers that can best serve your customers.
- Provides integrated firewall load balancing, and enables customers to double their firewall performance through intelligent traffic management to redundant firewall configurations.

## Link management

With the Link Controller, you can manage both inbound and outbound traffic over multiple links. You can distribute traffic based on performance, bandwidth cost, and bandwidth availability. The metrics you can specify are the limits on bandwidth usage and the pricing structure of your purchased bandwidth. When you specify the limits and pricing metrics for your links, the Link Controller then load balances the links based on those metrics.

Figure 1.1 shows the Modify Link screen, in the Configuration utility, where you define the metrics for a link.

Link List      Statistics      Help

**Modify Link external (192.168.15.254)**  
Edit settings and click "Update" button

Link	
Link Name	external
ISP Name	n/a
Link Ratio	1
SNMP	Enabled <input checked="" type="checkbox"/>
	Community String public
	Version 1
Bandwidth Limit	Inbound Traffic (Kbps) <input type="checkbox"/>
	Outbound Traffic (Kbps) <input type="checkbox"/>
	Total Traffic (Kbps) <input type="checkbox"/>

**Cost Analysis**  
Edit bandwidth costs and click "Update" button

Bandwidth Cost (per month)	
Prepaid Segment	Up to Kbps
Incremental Segment	Up to Kbps
	Cost
	Up to Kbps @ Cost

Update      Reset

Figure 1.1 The Modify Link screen in the Configuration utility

## Link monitoring

You can monitor several aspects of your managed links using the following tools:

- ◆ **Link Statistics**

The Link Statistics screen, in the Configuration utility, displays information about the status, bandwidth usage, bandwidth limits, and bandwidth costs for each of the links managed by the Link Controller. For more information on link statistics, review the online help for the Link Statistics screen, in the Configuration utility.

- ◆ **Internet Link Evaluator**

The Internet Link Evaluator shows the average round trip times, completion rates, and router hops over the links managed by the Link Controller for any of the seven continents. You can use the Internet Link Evaluator to determine which links best serve a particular global region. You can also use the Internet Link Evaluator to compare link performance to a particular global region. For more information on the Link Evaluator, review the online help for the Link Statistics screen, in the Configuration utility.

- ◆ **Transparent monitoring**

Transparent monitoring provides the health status of the routers for the managed links.



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## Using the Setup Utility

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- Creating the initial configuration with the Setup utility
- Connecting to the Link Controller for the first time
- Using the Setup utility for the first time
- Running the Setup utility to change settings



## Creating the initial configuration with the Setup utility

Once you install and connect the hardware, the next step in the installation process is to turn the system on and run the Setup utility. The Setup utility defines the initial configuration settings required to install the Link Controller into the network. You can run the Setup utility remotely from a web browser, or from an SSH client, or you can run it directly from the console.

Before you connect to the controller, we recommend that you gather the list of information outlined in the configuration worksheet provided with the Link Controller. Note that the screens you see are tailored to the specific hardware and software configuration that you have. For example, if you have a stand-alone system, the Setup utility prompts you to skip the redundant system screens.

Once you have configured the base network elements with the Setup utility, you might want to further enhance the configuration of these elements. For additional information about these configuration tasks, see Chapter 1, *Additional Base Network Configuration*, in the ***BIG-IP Link Controller Reference Guide***.

## Connecting to the Link Controller for the first time

The Setup utility prompts you to enter the same information, whether you run the utility from a web browser or from the command line. When the utility completes, we recommend that you reboot the controller. This automatically removes the default IP address and root password provided specifically for the purposes of running the Setup utility remotely. The Link Controller replaces the default IP address and root password with the password and IP addresses that you define while running the utility.

## Running the Setup utility from a console or serial terminal

Before you can run the Setup utility from either the console or a serial terminal, you must first log in. Use the following default user name and password to log in.

Username: **root**

Password: **default**

After you log in, you can start the utility directly from the console or serial terminal by typing the command **setup**. Once you complete the utility, we recommend that you reboot the Link Controller. The Link Controller automatically reboots if you are running the utility for the first time from the console.

◆ **Note**

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*If you want to set up a terminal connection directly to the Link Controller, see the **BIG-IP Link Controller Reference Guide**, Chapter 7, **Using a serial terminal with the Link Controller**.*

## Running the Setup utility remotely

You can run the Setup utility remotely only from a workstation that is on the same LAN as the controller. To allow remote connections for the Setup utility, the Link Controller comes with two pre-defined IP addresses, and a pre-defined root password. The default root password is **default**, and the preferred default IP address is **192.168.1.245**. If this IP address is unsuitable for your network, the Link Controller uses an alternate IP address, **192.168.245.245**. However, if you define an IP alias on an administrative workstation in the same IP network as the Link Controller, the controller detects the network of the alias and uses the corresponding default IP address.

Once the utility finishes and the system reboots, these default IP addresses are replaced by the information that you entered in the Setup utility.

## Setting up an IP alias for the default IP address before you start the controller

You must set up an IP alias for your remote workstation before you turn on the controller and start the Setup utility. The remote workstation must be on the same IP network as the controller. If you add this alias prior to booting up the Link Controller, the controller detects the alias and uses the corresponding address.

### To set up an IP alias for the alternate IP address

The IP alias must be in the same network as the default IP address you want the Link Controller to use. For example, on a UNIX workstation, you might create one of the following aliases:

- ◆ If you want the controller to use the default IP address **192.168.1.245**, then add an IP alias to the machine you want to use to connect to the controller using the following command:  

```
ifconfig exp0 add 192.168.1.1
```
- ◆ If you want to use the default IP address **192.168.245.245**, then add an IP alias such as:  

```
ifconfig exp0 add 192.168.245.1
```

**◆ WARNING**

*On Microsoft Windows® or Windows NT® machines, you must use a static IP address, not DHCP. Within the network configuration, add an IP alias in the same network as the IP in use on the controller. For information about adding a static IP address to a Microsoft Windows operating system, please refer to your vendor's documentation.*

**Determining which default IP address is in use**

After you configure an IP alias on the administrative workstation in the same IP network as the Link Controller and you turn the system on, the Link Controller sends ARPs on the internal VLAN to see if the preferred **192.168.1.245** IP address is in use. If the address is appropriate for your network and is currently available, the Link Controller assigns it to the internal VLAN. You can immediately use it to connect to the controller and start the Setup utility.

If the alternate network is present on the LAN, **192.168.245.0/24**, or if the node address **192.168.1.245** is in use, then the Link Controller assigns the alternate IP address **192.168.245.245** to the internal VLAN instead.

**Starting the utility from a web browser**

When you start the utility from a web browser, you use the selected default IP address as the application URL.

**To start the Setup utility in a web browser**

1. Open a web browser on a workstation connected to the same IP network as the internal VLAN of the controller.
2. Type the following URL, where **<default IP>** is the IP address in use on the Link Controller internal VLAN.  
**https://<default IP>**
3. At the login prompt, type **root** for the user name, and **default** for the password.  
The Configuration utility screen opens.
4. On the Configuration utility welcome screen, click **Setup Utility**.
5. Fill out each screen using the information from the Setup utility configuration list.  
After you complete the Setup utility, the Link Controller reboots and uses the new settings you defined

**◆ Note**

*You can rerun the Setup utility from a web browser at any time by clicking the Setup utility link on the welcome screen.*

## Starting the utility from the command line

You can run the command line version of the Setup utility from the console or serial terminal, or from a remote SSH client or from a Telnet client.

### To start the Setup utility from the console

1. At the login prompt, type **root** for the user name, and **default** for the password.
2. At the Link Controller prompt, type the following command to start the command-line based Setup utility.

```
setup
```

3. Fill out each screen using the information from the Configuration worksheet.  
After you complete the Setup utility, the Link Controller reboots and uses the new settings you defined.

### To start the Setup utility from the command line from a remote administrative workstation

1. Start an SSH client on a workstation connected to the same IP network as the internal VLAN of the controller. (See the ***BIG-IP Link Controller Reference Guide***, Chapter 7, *Downloading the SSH client to your administrative workstation*, for information on downloading the SSH client from the Link Controller.)

2. Type the following command, where **<default IP>** is the IP address in use on the Link Controller internal VLAN.

```
ssh <default IP>
```

3. At the login prompt, type **root** for the user name, and **default** for the password.
4. At the Link Controller prompt, type the following command to start the command-line based Setup utility.

```
setup
```

5. Fill out each screen using the information from the Configuration worksheet. After you complete the Setup utility, reboot the Link Controller by typing the following command:

```
reboot
```

---

#### ◆ Note

You can rerun the Setup utility at any time using the **setup** command.

## Using the Setup utility for the first time

The following sections provide detailed information about the settings that you define in the Setup utility.

### Keyboard type

Select the type of keyboard you want use with the Link Controller. The following options are available:

- Belgian
- Bulgarian MIK
- French
- German
- Japanese - 106 key
- Norwegian
- Spanish
- Swedish
- US + Cyrillic
- US - Standard 101 key (default)
- United Kingdom

### Link Controller root password

A root password allows you command line administrative access to the Link Controller. We recommend that the password contain a minimum of 6 characters, but no more than 32 characters. Passwords are case-sensitive, and we recommend that your password contain a combination of upper- and lower-case characters, as well as numbers and special characters, for example, `!@#$$%^&*`. Once you enter a password, the Setup utility prompts you to confirm your root password by typing it again. If the two passwords match, your password is immediately saved. If the two passwords do not match, the Setup utility provides an error message and prompts you to re-enter your password.

### Host name

The host name identifies the Link Controller itself. Host names must be fully qualified domain names (FQDNs). The host portion of the name must start with a letter, and must be at least two characters. The name, or host part of the name, must be 39 characters or less. The label part of the name must be 63 characters or fewer. For example:

```
<host 39 characters or less>.<label 63 characters or less>.net
```

## Configuring a default gateway pool

You configure the default gateway pool for outbound link load balancing. The default gateway pool is a pool of the default routes for all links that you want the Link Controller to manage. Type an IP address for each link you want to load balance. If a gateway in the default gateway pool becomes inactive, existing connections through the inactive gateway are routed through another gateway in the default gateway pool. After you complete the Setup utility, if you typed more than one default gateway IP address, a pool named **default\_gateway\_pool** is created.

### **WARNING**

---

*Default gateway IP addresses must have a corresponding self IP address/netmask combination on the Link Controller.*

## Redundant system settings

There are two types of settings you need to define for redundant systems: unit IDs, and fail-over IP addresses.

### Unit IDs

The default unit ID number is **1**. If this is the first unit in the redundant system, use the default. When you configure the second unit in the system, type **2**.

### Choosing a fail-over IP address

A fail-over IP address is the IP address of the unit which will take over if the current unit fails. Type in the IP address configured on the internal interface of the other Link Controller in the redundant pair.

## Setting the interface media type

Configure media settings for each interface. The media type options depend on the network interface cards included in your hardware configuration. The Setup utility prompts you with the settings that apply to the interfaces installed in the controller. The Link Controller supports the following media types:

- auto
- 10baseT
- 10baseT, FDX
- 100baseTX
- 100baseTX, FDX
- Gigabit Ethernet

**◆ Note**

*For best results, choose the **auto** setting. In some cases, devices configured for the auto media are incompatible, and the proper duplex setting is not negotiated. In these cases, you may need to set the media settings to the same speed and duplex on this device and the corresponding switch or host. Check your switch or hub documentation for this information.*

**◆ WARNING**

*The Setup utility lists only the network interface devices that it detects during system boot. If the utility lists only one interface device, the additional network adapters may have come loose during shipping. Check the LED indicators on the network adapters to ensure that they are working and are connected.*

## Configuring VLANs and IP addresses

You create a VLAN for each link in the configuration. The Link Controller has two default VLANs, **internal** and **external**. You can rename these VLANs to link names for easier management. In most configurations, you need to add VLANs to represent all of your external links. Follow the onscreen prompts to configure any additional VLANs that you need.

Determine whether you want to have security turned **on** for a VLAN, or **off** for the VLAN. Then, type the IP address settings for the VLAN. The IP address settings include:

- Security settings
- IP address, netmask, and broadcast
- Floating self IP address, netmask, and broadcast (for redundant systems only)

We recommend that you set the floating self IP address as the default route for target devices, such as servers. The floating self IP address is owned by the active unit in an active/standby configuration.

**◆ Note**

*The IP addresses of the external VLANs are not the IP address of your site or sites. The IP addresses of the sites themselves are specified by the virtual IP addresses associated with each virtual server you configure.*

## Assigning interfaces to VLANs

After you configure the VLANs for each link on the Link Controller, you assign interfaces to the VLANs. Note that each VLAN should be associated with an interface.

## Associating the primary IP address and VLAN with the host name

After you assign interfaces to VLANs, you can choose one VLAN/IP address combination as the primary IP address to associate with the controller host name.

## Configuring remote web server access

The Link Controller web server provides the ability to set up remote web access on each VLAN. When you set up web access on a VLAN, you can connect to the web-based Configuration utility through the VLAN. To enable web access, specify a fully qualified domain name (FQDN) for each VLAN. The Link Controller web server configuration also requires that you define a user ID and password. If SSL is available, the configuration also generates authentication certificates.

The Setup utility guides you through a series of screens to set up remote web access.

- The first screen prompts you to select the VLAN you want to configure for web access. After you select an interface to configure, the utility prompts you to type an FQDN for the interface. You can configure web access on one or more interfaces.
- After you configure the interface, the utility prompts you for a user name and password. After you type a user name and password, the utility prompts you for a vendor support account. The vendor support account is not required.
- The certification screen prompts you for country, state, city, company, and division.

You can also add users to the existing password file, change a password for an existing user, or recreate the password file, without actually repeating the remote web server configuration process.

---

### ◆ WARNING

*If you ever change the IP addresses or host names on the Link Controller interfaces, you must reconfigure the Link Controller web server and the portal to reflect your new settings.*

---

### ◆ WARNING

*If you have modified the remote web server configuration outside of the Configuration utility, be aware that some changes may be lost when you run the Setup utility. This utility overwrites the **httpd.conf** file and **openssl.conf**.*

## Setting the time zone

Next, you specify the time zone for the Link Controller. This ensures that the clock for the Link Controller is set correctly, and that dates and times recorded in log files correspond to the time zone of the system administrator. Scroll through the list to find the time zone at your location. Note that one option may appear with multiple names.

## Configuring the DNS proxy forwarding settings

You need to complete this step only if you want machines inside your Link Controller managed network to use DNS servers outside of that network (for example, for reverse DNS lookup from a web server).

Specify the DNS name server and domain name for DNS proxy forwarding by the Link Controller. For more information on DNS proxy forwarding, see the ***BIG-IP Link Controller Reference Guide***, Chapter 7, *Configuring DNS on the Link Controller*.

## Configuring remote administrative access

After you configure remote web access, the Setup utility prompts you to configure remote command line access. The first screen you see is the Configure SSH screen, which prompts you to type an IP address for SSH command line access.

When you configure shell access, the Setup utility prompts you to create a support account for that shell. You can use this support account to provide access to a support engineer.

When the Setup utility prompts you to enter an IP address for administration, you can type a single IP address, or a list of IP addresses from which the Link Controller will accept administrative connections. (These can be either remote shell connections, or connections to the web server on the Link Controller.) To specify a range of IP addresses, you can use the asterisk (\*) as a wildcard character in the IP addresses.

The following example allows remote administration from all hosts on the **192.168.2.0/24** network:

```
192.168.2.*
```

---

### ◆ Note

*For administration purposes, you can connect to the Link Controller floating self IP address, which always connects you to the active unit in an active/standby redundant system. To connect to a specific unit, connect directly to the IP address of that Link Controller.*

## Configuring NTP support

You can synchronize the time on the controller to a public time server by using Network Time Protocol (NTP). NTP is built on top of TCP/IP and assures accurate, local timekeeping with reference to clocks located on the Internet. This protocol is capable of synchronizing distributed clocks, within milliseconds, over long periods of time. If you choose to enable NTP, make sure UDP port **123** is open in both directions when the controller is behind a firewall.

## Completing the initial configuration

Once you have configured the previous settings, the Link Controller commits the configuration and reboots the system. Once the controller has rebooted, you can log in to the Configuration utility and configure the Link Controller. Refer to Chapter 3, *Configuring Links for Simple ISP Load Balancing*, for instructions on setting up the Link Controller to manage multiple ISP links.

## Running the Setup utility to change settings

You normally run the Setup utility when the system is first installed, as part of the installation procedure. However, you can also use the command line Setup utility to change existing settings at any time. This section describes running the Setup utility to change settings after you run it initially.

To run the Setup utility from the command line, type in the following command:

```
setup
```

After you complete the initial configuration, the Setup utility presents a menu of individual configuration options.

The Setup utility menu is divided into two different sections: required and optional. The Setup utility includes the following required configuration options:

- Set the default gateway pool
- Configure VLANs and networking
- Set host name
- Set the root password
- Configure web servers
- Steps for redundant systems (redundant systems only)

The following configuration selections are optional:

- Configure DNS
- Configure FTP
- Set keyboard type
- Define time servers
- Initialize the iControl portal
- Configure SSH
- Configure telnetd
- Set time zone

```

lqq I N I T I A L   S E T U P   M E N U qqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqk
x                                                                                                     x
x                                                                                                     x
x   Choose the desired configuration function from the list below.                                     x
x                                                                                                     x
x                                                                                                     x
x   (A) All configuration steps                               (R) Steps for redundant systems           x
x                                                                                                     x
x   REQUIRED                                                                                             x
x   (E) Set default gateway pool                             (V) Configure VLANs & networking         x
x   (H) Set host name                                       (W) Configure web servers                 x
x   (P) Set root password                                       x                                           x
x                                                                                                     x
x   OPTIONAL                                                                                           x
x   (D) Configure DNS                                         (O) Configure remote access              x
x   (F) Configure FTP                                         (S) Configure SSH                        x
x   (I) Initialize iControl portal                             (T) Configure Telnetd                    x
x   (K) Set keyboard type                                       (R) Configure RSH                         x
x   (M) Define time servers                                   (Z) Set time zone                         x
x                                                                                                     x
x                                                                                                     x
x   Enter Choice:                                                                                       x
x                                                                                                     x
mqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqj

```

**Figure 2.1** The Setup utility menu. Some of these options may not be available on your system.

## Options available only through the Setup utility menu

This section contains descriptions of options that are available only through the Setup utility menu. These options include:

- Initializing the iControl portal
- Configuring remote access
- Configure RSH

## Initialize the iControl portal

This option is available in the menu only after you create the initial software configuration. Select this option to configure the CORBA ports (IIOP and FSSL). This option prompts you for a list of IP addresses or host names you want to embed as objects in the Portal object reference. Typically, in a redundant system, this list includes the fail-over IP address of the other Link Controller in the redundant system.

This option prompts you to set the Portal to use IP addresses instead of DNS names. If the Portal is set to use IP addresses, the Link Controller does not have to do a DNS lookup.

In addition to these settings, you can change the following iControl portal settings:

- You can set the security mode of the portal. You can allow the portal to handle non-secure requests.
- You can change the name of the Portal object reference file.
- You can specify the Portal PID file name.

## Configuring remote access

This option is available in the menu only after you create the initial configuration. Use this option to modify remote access settings.

## Configuring RSH

You can configure an RSH shell for non-secure access to the Link Controller. Use this option only if you are unable to set up an SSH shell.



# 3

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## Configuring Links for Simple ISP Load Balancing

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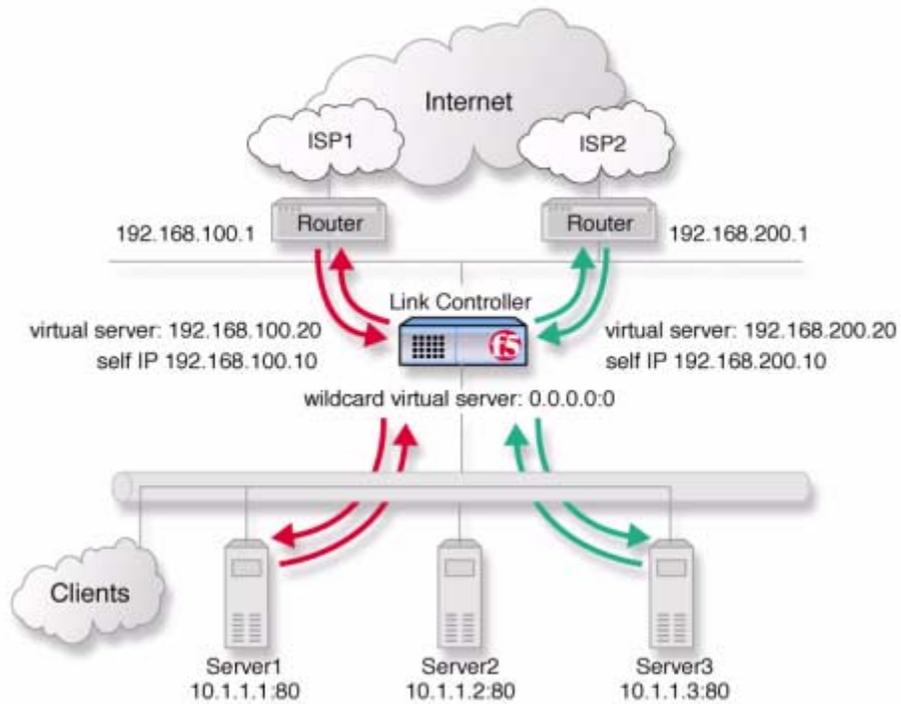
---

- Introducing simple ISP load balancing
- Configuring ISP load balancing
- Additional configuration options



## Introducing simple ISP load balancing

You can configure the Link Controller to provide high availability for incoming and outgoing traffic with multiple Internet service providers (ISPs). This configuration eliminates the possibility that if one ISP connection fails, your web site or Internet connectivity fails.



*Figure 3.1 An example of simple ISP load balancing.*

### ◆ Note

*This type of configuration assumes that you have completed the base configuration created by the Setup utility. For more information, see **Creating the initial configuration with the Setup utility**, on page 2-1. To use this configuration, you must configure at least three VLANs when you create the initial configuration: one VLAN for each ISP, and one VLAN for the internal network.*

*The IP addresses used in this example are for demonstration only. You should substitute IP addresses appropriate for your network.*

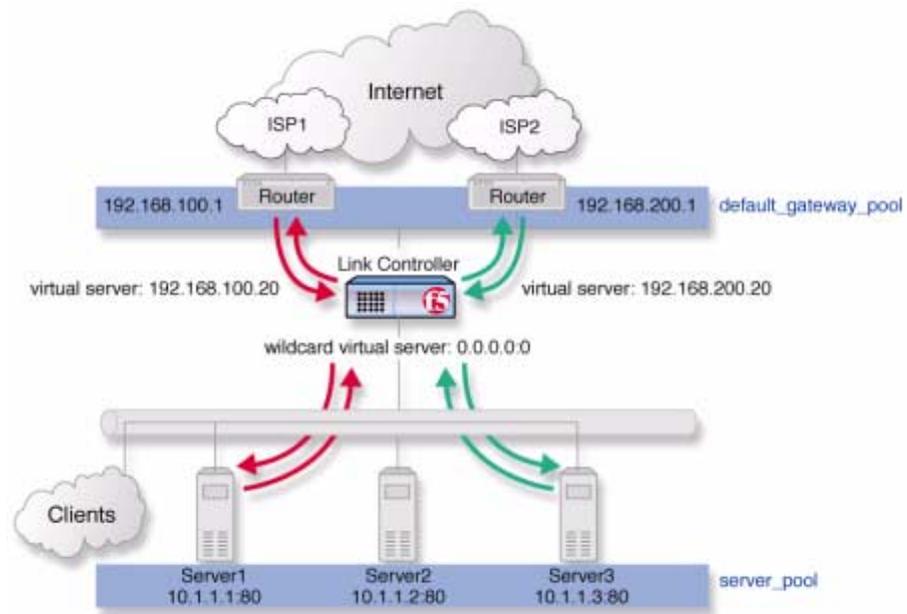
## Configuring ISP load balancing

When you set up ISP, or link, load balancing, you have several tasks to complete on the Link Controller:

- **Create two load balancing pools**  
You must define one pool that load balances the content servers. The other pool, the **default\_gateway\_pool**, is created when you add the IP addresses of the links when you set the default gateways in the Setup utility.
- **Configure virtual servers**  
For each link, you need to configure a pair of virtual servers:
  - One virtual server in the network of the link for each ISP, to load balance inbound connections across the servers.
  - One wildcard virtual server (**0.0.0.0**) to load balance outbound connections across the routers.
- **Verify the default gateway pool**  
Verify that the default gateway pool that contains the IP address of each ISP, or link, is configured correctly.
- **Configure SNAT automap**  
Configure SNAT automap for outbound traffic so outbound requests can be sent through either link.
- **Add a wide IP for inbound load balancing**  
Add a wide IP to handle inbound DNS requests for each pair of virtual servers you add for each link.
- **Create transparent monitors**  
Create transparent monitors to verify that the path to or through ISP is available.
- **Manage links**  
Additional configuration options are available for each link.

### Defining the pools for an additional Internet connection

First, define one pool that load balances the content servers, and one pool to load balance the routers. Figure 3.2 is an example of how the network devices and servers are grouped into pools.



*Figure 3.2 The pools required for link load balancing*

### To create the inbound load balancing pool using the Configuration utility

1. In the navigation pane, click **Pools**.  
The Pools screen opens.
2. Click the **Add** button.  
The Add Pool screen opens.
3. For each pool, enter the pool name and member addresses in the Add Pool screen. (For additional information about configuring a pool, click the **Help** button.)

#### *Configuration notes*

*For the example in Figure 3.1:*

*Create the pool **server\_pool** containing the members **10.1.1.1:80**, **10.1.1.2:80**, and **10.1.1.3:80**.*

### **To create the default gateway pool using the Configuration utility**

If you configured more than one default gateway in the Setup utility, the Link Controller already created a **default\_gateway\_pool** pool. You can skip this step. If you do not have a **default\_gateway\_pool**, create one by completing the following task.

1. In the navigation pane, click **Pools**.  
The Pools screen opens.
2. Click the **Add** button.  
The Add Pool screen opens.
3. For each pool, enter the pool name and member addresses in the Add Pool screen. (For additional information about configuring a pool, click the **Help** button.)

#### *Configuration notes*

*For the example in Figure 3.1:*

*Create the pool **default\_gateway\_pool** containing the router inside addresses **192.168.100.1:0** and **192.168.200.1:0**.*

## **Defining the virtual servers for an additional Internet connection**

After you create the pools, you configure the virtual servers, one for each link that load balances inbound connections across the servers, and one wildcard virtual server to load balance outbound connections across the routers. Each of the virtual servers you create references either the **default\_gateway\_pool** or the **server\_pool** in the configuration.

### **To define the virtual servers for inbound traffic using the Configuration utility**

1. In the navigation pane, click **Virtual Servers**.  
The Virtual Servers Screen opens.
2. Click the **Add** button.  
The Add Virtual Server screen opens.
3. For each virtual server, enter the virtual server address and pool name. (For additional information about configuring a virtual server, click the **Help** button.)

#### *Configuration notes*

*For the example in Figure 3.1:*

*Note that you must create a virtual server for each link. For this example, create the virtual servers **192.168.100.20:80** and **192.168.200.20:80** use pool **server\_pool**.*

**To define a wildcard virtual server for outbound traffic using the Configuration utility**

1. In the navigation pane, click **Virtual Servers**.  
The Virtual Servers Screen opens.
2. Click the **Add** button.  
The Add Virtual Server screen opens.
3. For each virtual server, enter the virtual server address and pool name. (For additional information about configuring a virtual server, click the **Help** button.)

**Configuration notes**

*For the example in Figure 3.1:*

*For the outbound connections, create a wildcard virtual server **0.0.0.0:0** and use pool **default\_gateway\_pool**.*

**Setting the default gateway pool**

If a Link Controller does not have a predefined route for network traffic, the unit automatically sends traffic to the pool that you define as the default gateway pool. Think of the default gateway pool as a pool of default routes.

In a Link Controller configuration, the default gateway pool must contain two or more gateway IP addresses, or ISPs. If a gateway in the default gateway pool becomes inactive, existing connections through the inactive gateway are routed through another gateway in the default gateway pool.

**◆ Note**

---

*If you configured more than one default gateway in the Setup utility, the Link Controller automatically created a **default\_gateway\_pool** pool.*

**◆ WARNING**

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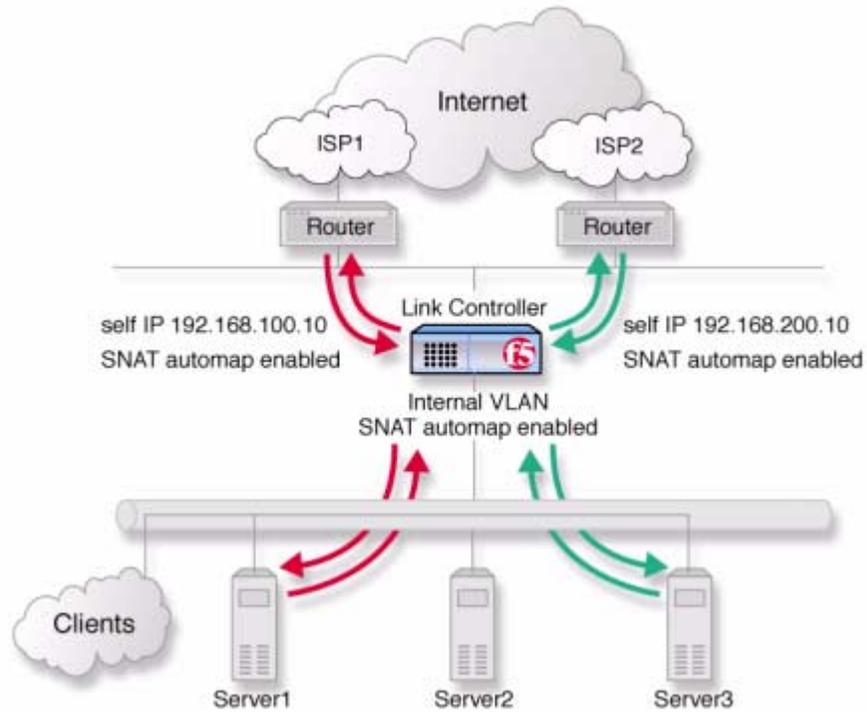
*Default gateway IP addresses must have a corresponding self IP address/netmask combinations on the Link Controller.*

**To set the default gateway pool from the Configuration utility**

1. In the navigation pane, click **System**.  
The System screen opens.
2. Click the Properties tab.  
The Properties screen opens.
3. From the **Default Gateway Pool** list, select the pool that contains the internal IP addresses of the gateway routers.  
In the example in this document, this is the **default\_gateway\_pool** pool.
4. Click **Apply**.

## Configuring SNAT automap for outbound traffic

You must now set up secure network address translation (SNAT) automap for outbound traffic so that clients receive replies through the same ISP that their requests originated from. Specifically, you must configure SNAT automap for each self IP address associated with a link on the Link Controller, and on each internal VLAN. Figure 3.3 is an example of the SNAT automap configuration for link load balancing.



**Figure 3.3** Enable the SNAT automap feature on self IP addresses and on internal VLANs.

To set up a SNAT automap, you must enable SNAT automap for each of the self IP addresses and on each internal VLAN.

### To enable SNAT automap for each self IP address on the Link Controller

1. In the navigation pane, click **Network**.  
The Network screen opens.
2. In the Network screen, click the Self IP Addresses tab.  
The Self IP Addresses screen opens.
3. In the Self IP address list, click a self IP address.  
The self IP address properties screen for that self IP address opens.
4. Check the **Enable SNAT Automap** box.
5. Click the **Apply** button.
6. Repeat steps 3 through 5 for each self IP address.

### To enable SNAT automap on the internal VLAN

1. In the navigation pane, click **NATs**.  
The NAT configuration screen opens.
2. Click the SNATs tab.  
The SNAT configuration screen opens.
3. Click the **Add** button.  
The Add SNAT screen opens.
  - For the Translation Address, click **Automap**.
  - In the Origin List section, select the internal VLAN from the **Origin VLAN** list and click the Add button (>>) to move it to the **Current List**.
4. Click the **Done** button.

## Adding a wide IP for inbound load balancing

To complete the link load balancing configuration, you must configure a wide IP and wide IP pool for each pair of virtual servers you created for each link. Each wide IP in your configuration has a pool of virtual servers that the Link Controller load balances incoming DNS requests to. The wide IP pool is made up of only virtual servers managed by the Link Controller. When you configure the wide IP pool, you specify the load balancing methods that the Link Controller applies to the incoming DNS requests.

### To add a new wide IP in the Configuration utility

1. In the navigation pane, click **Wide IPs**.  
The Wide IP List screen opens.
2. On the toolbar, click **Add Wide IP**.  
The Add a New Wide IP screen opens.
3. Add the settings for the wide IP.  
For information about the specific settings, click **Help** on the toolbar.
4. Click **Next**.  
The Configure Load Balancing for New Pool screen opens.
5. Add the settings for the wide IP pool. Note that you should set the preferred load balancing mode to **Round Robin**. For information about the additional settings, click **Help** on the toolbar.
6. Click **Next**.  
The Select Virtual Servers screen opens.
7. Check all the virtual servers that should be in this wide IP pool. You should include a virtual server for each link in the pool.
8. Click **Finish**.  
The Wide IP List screen opens, and you see the newly-created wide IP in the list.

## Configuring transparent monitors for the links

When you create the default gateway pool, the Link Controller automatically creates simple ICMP monitors that check to make sure the IP addresses in the default gateway pool are available to the Link Controller. In addition to the default ICMP monitors, you can configure transparent monitors that verify the path taken by traffic through each link. You can use transparent monitors to check the availability of a device in an ISP network or on the Internet.

### To configure a transparent monitor using the Configuration utility

1. In the navigation pane, click **Monitors**.  
The Monitors screen opens.
2. Click the **Add** button.  
The Add Monitor screen opens.
3. In the Add Monitor screen, type in the name of your monitor, for example **LinkMonitor** (it must be different from the monitor template name), and select the **tcp** monitor template.
4. Click the **Next** button.  
The Configure Basic Properties screen opens. The default **interval** and **timeout** values should be sufficient.
5. Click the **Next** button.
6. Check the **Transparent** box, and click the **Next** button.  
The Configure Destination IP and Service (Alias) screen opens.
7. In the **Destination IP** box, type the IP address of a network device on the other side of the router that you want to monitor.
  - If you are monitoring a device at the ISP, you should contact the ISP for more information about how to configure this monitor.
  - If you are monitoring a device in an ISP network, you must configure a separate monitor, with a specific IP and port combination for the device, for each ISP network.
  - If you are monitoring a device on the public Internet, you can create one monitor that is applicable for all links.
8. In the **Destination Service** box, type the service number you want to monitor. For example, if Telnet is enabled on the destination device, type **23**.
9. When you have finished configuring the monitor, click **Done**.

---

#### ◆ Note

*You can also set up ICMP transparent monitors. When your ISP does not allow TCP monitoring, use ICMP monitoring instead.*

### **To associate the monitor with the members of the default gateway pool**

After you create the monitors to check the availability of the links, you must associate the monitors with the routers in the default gateway pool.

1. In the navigation pane, click **Monitors**.  
The Monitors screen opens.
2. Click the Node Associations tab.  
The Node Association screen opens.
3. From the **Choose Monitor** list, select the monitor you created to monitor links.
4. Click the Add button (>>) to move the monitor into the **Monitor Rule** box.
5. In the node list table, in the Associate Current Monitor Rule column, check the check box for each node address that is in the default gateway pool.
6. Click the **Apply** button.

## Monitoring link performance

After you complete the Link Controller configuration, you can monitor the performance of the links by using one or more of the following tools in the Configuration utility:

- Internet Link Evaluator
- Link Statistics screens
- Link Report screens

You can use the screens to analyze the traffic patterns in your network so that you can adjust the Link Controller configuration to best meet your link management objectives. The following sections describe the screens and how to view them.

### Working with the Internet Link Evaluator

The Internet Link Evaluator displays the average round trip times, the average completion rates, and the average router hops for the links in your configuration. You can use the Internet Link Evaluator to compare actual performance between links and between ISPs.

#### **To view the Internet Link Evaluator**

1. In the navigation pane, expand the **Link Statistics** item, and then click **Link Evaluator**.  
The Internet Link Evaluator screen opens.
2. For more information about interpreting the data on this screen, click the **Help** button on the toolbar.

## Working with the link statistics screens

The link statistics screens display current data for the physical and logical elements of the configuration. Each link statistics screen displays a particular aspect of your configuration.

### To view the Link Statistics screens

1. In the navigation pane, expand the **Link Statistics** item, and then click one of the link statistics objects.  
The statistics screen for the object you selected opens.
2. For more information about a link statistics screen, click the **Help** button on the toolbar.

## Working with the Link Report screen

The Link Report screen displays performance graphs for three time intervals: 30 minutes, 6 hours, and 24 hours. The graphs illustrate the volume of inbound and outbound traffic over a link during the specified time interval. The graphs also indicate any bandwidth pricing levels you have set for a link. You can view a Link Report screen for all the links in the configuration, or for a particular link in the configuration.

### To view the Link Report screen for all links

1. In the navigation pane, expand the **Link Statistics** item, and then click **Links**.  
The Link Statistics screen opens.
2. Click the **Graph Link Summary** button.  
The Link Report for All Links screen opens, where you can review the bandwidth usage for all links in the most recent 30-minute, 6-hour, and 24-hour intervals.

### To view the Link Report screen for a particular link

1. In the navigation pane, expand the **Link Statistics** item, and then click **Links**.  
The Link Statistics screen opens.
2. Click the **Graph Link Detail** button for the link whose data you want to review.  
The Link Report screen opens, where you can review the bandwidth usage for the particular link in the most recent 30-minute, 6-hour, and 24-hour intervals.

## Additional configuration options

Whenever a Link Controller is configured, you have a number of options:

- You have the option in all configurations to configure a Link Controller redundant system for fail-over. Refer to Chapter 8, *Configuring a Redundant System*, in the ***BIG-IP Link Controller Reference Guide***.
- All configurations have health monitoring options. Refer to *Health Monitors* in Chapter 2, *Configuring the High-Level Network*, in the ***BIG-IP Link Controller Reference Guide***.
- When you create a pool, there is an option to set up persistence, and a choice of load balancing methods. Refer to *Pools* in the Chapter 2, *Configuring the High-Level Network*, in the ***BIG-IP Link Controller Reference Guide***.
- When you create a wide IP, you have a choice of load balancing modes. Refer to Chapter 5, *Inbound Load Balancing*, in the ***BIG-IP Link Controller Reference Guide***.



# 4

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## Configuring Cost-Based ISP Load Balancing

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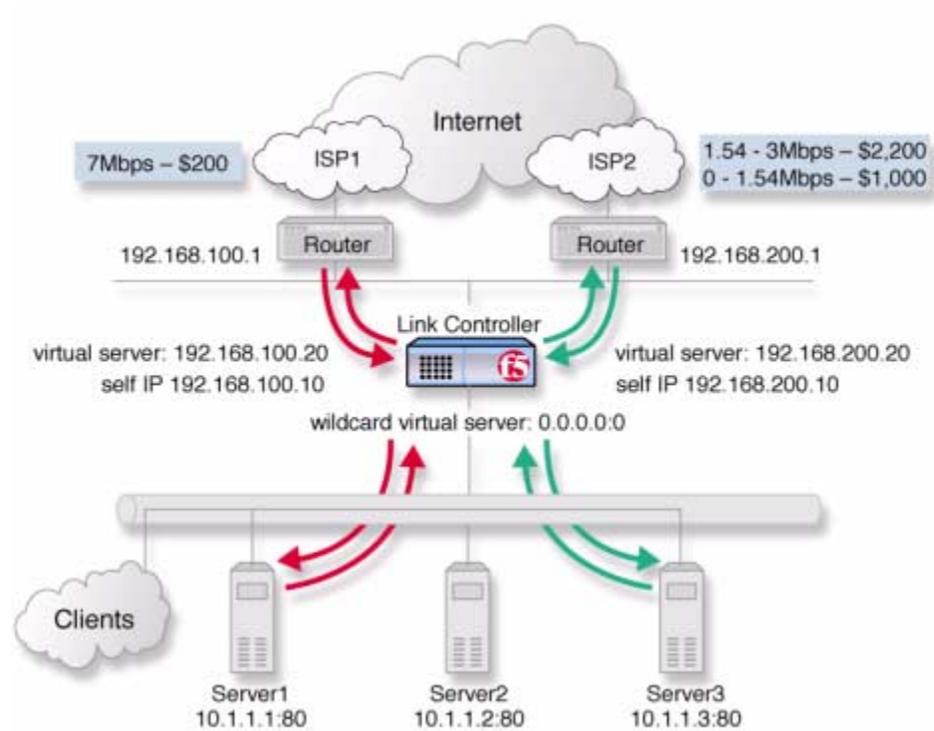
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- Introducing cost-based ISP load balancing
- Configuring cost-based ISP load balancing
- Additional configuration options



## Introducing cost-based ISP load balancing

You can configure the Link Controller to load balance traffic based on the costs associated with traffic on each link. This configuration provides high availability and helps you control how links are used based on the pricing structure of each link's bandwidth.



**Figure 4.1** An example of cost-based ISP load balancing

In the example in Figure 4.1, **ISP1** handles up to .7 Mbps for \$200/Mbps. The second ISP, **ISP2**, has two pricing tiers. From 0 to 1.54 Mbps, traffic costs \$1000/Mbps. From 1.54 to 3 Mbps, traffic costs \$2200/Mbps. In this scenario, the Link Controller directs traffic to **ISP1** if **ISP2** is unavailable, or if traffic spikes above the 3 Mbps level.

Another way to configure the Link Controller in this situation would be to direct traffic to **ISP1** if the traffic on **ISP2** exceeds 1.54 Mbps. To do this, you could set a cost limit on the **ISP2** link.

### ◆ Note

*This type of configuration assumes that you have completed the base configuration created by the Setup utility. For more information, see **Creating the initial configuration with the Setup utility**, on page 2-1. To use this configuration, you must configure at least three VLANs when you create the initial configuration: one VLAN for each ISP, and one VLAN for*

*the internal network.*

*The IP addresses used in this example are for demonstration only. You should substitute IP addresses appropriate for your network.*

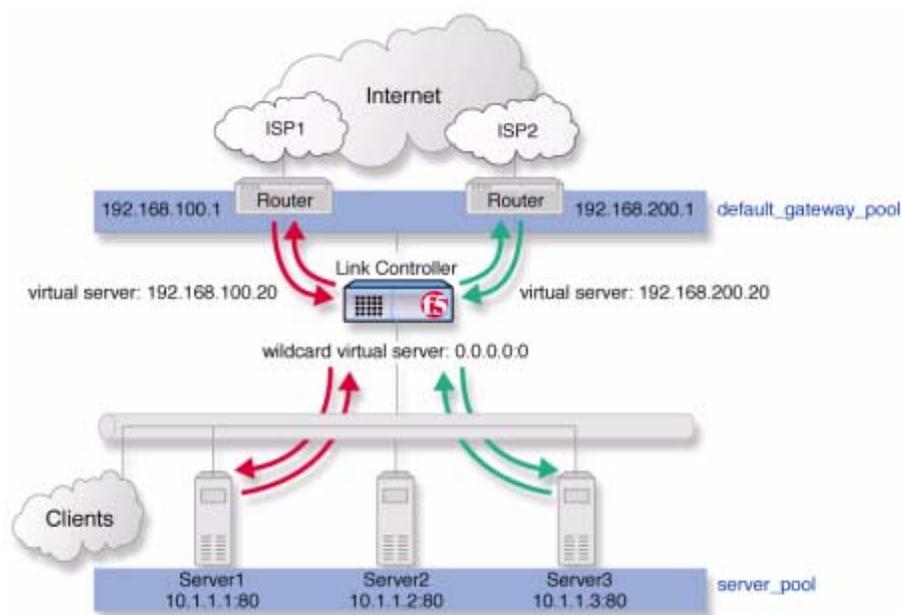
## Configuring cost-based ISP load balancing

When you set up cost-based ISP, or link, load balancing, you have several tasks to complete on the Link Controller:

- **Create two load balancing pools**  
You must define one pool that load balances the content servers. The other pool, the **default\_gateway\_pool**, is created when you add the IP addresses of the links when you set up the default gateways in the Setup utility.
- **Configure virtual servers**  
For each link, you need to configure the following pair of virtual servers:
  - One virtual server for each ISP (link), in the network of the link, to load balance inbound connections across the servers.
  - One wildcard virtual server (**0.0.0.0**) to load balance outbound connections across the routers.
- **Verify the default gateway pool**  
Verify that the default gateway pool that contains the IP address of each ISP, or link, is configured correctly.
- **Configure SNAT automap**  
Configure SNAT automap for outbound traffic so outbound requests can be sent through either link.
- **Add a wide IP for inbound load balancing**  
Add a wide IP to handle inbound DNS requests for each pair of virtual servers you add for each link.
- **Configure cost values for each link**  
Configure the cost values you want to associate with each link. These are the values that the Link Controller uses to direct traffic to a particular link.
- **Create transparent monitors**  
Create transparent monitors to verify that the path to or through ISP is available.
- **Manage links**  
Additional configuration options are available for each link.

### Defining the pools for an additional Internet connection

First, define one pool that load balances the content servers, and one pool to load balance the routers. Figure 4.2 is an example of how the network devices and servers are grouped into pools.



*Figure 4.2 The pools required for link load balancing*

### To create the inbound load balancing pool using the Configuration utility

1. In the navigation pane, click **Pools**.  
The Pools screen opens.
2. Click the **Add** button.  
The Add Pool screen opens.
3. For each pool, enter the pool name and member addresses in the Add Pool screen. (For additional information about configuring a pool, click the **Help** button.)

#### *Configuration notes*

*For the example in Figure 4.1:*

*Create the pool **server\_pool** containing the members **10.1.1.1:80**, **10.1.1.2:80**, and **10.1.1.3:80**.*

### **To create the default gateway pool using the Configuration utility**

If you configured more than one default gateway in the Setup utility, the Link Controller already created a **default\_gateway\_pool** pool. You can skip this step. If you do not have a **default\_gateway\_pool**, create one by completing the following task.

1. In the navigation pane, click **Pools**.  
The Pools screen opens.
2. Click the **Add** button.  
The Add Pool screen opens.
3. For each pool, enter the pool name and member addresses in the Add Pool screen. (For additional information about configuring a pool, click the **Help** button.)

#### *Configuration notes*

*For the example in Figure 4.1:*

*Create the pool **default\_gateway\_pool** containing the router inside addresses **192.168.100.1:0** and **192.168.200.1:0**.*

## **Defining the virtual servers for an additional Internet connection**

After you create the pools, you can configure the virtual servers, one for each link that load balances inbound connections across the servers, and one wildcard virtual server to load balance outbound connections across the routers.

### **To define the virtual servers for inbound traffic using the Configuration utility**

1. In the navigation pane, click **Virtual Servers**.  
The Virtual Servers Screen opens.
2. Click the **Add** button.  
The Add Virtual Server screen opens.
3. For each virtual server, enter the virtual server address and pool name. (For additional information about configuring a virtual server, click the **Help** button.)

#### *Configuration notes*

*For the example in Figure 4.1:*

*Note that you must create a virtual server for each link. For this example, create the virtual servers **192.168.100.20:80** and **192.168.200.20:80** use pool **server\_pool**.*

### To define a wildcard virtual server for outbound traffic using the Configuration utility

1. In the navigation pane, click **Virtual Servers**.  
The Virtual Servers Screen opens.
2. Click the **Add** button.  
The Add Virtual Server screen opens.
3. For each virtual server, enter the virtual server address and pool name. (For additional information about configuring a virtual server, click the **Help** button.)

#### *Configuration notes*

*For the example in Figure 4.1:*

*For the outbound connections, create a wildcard virtual server **0.0.0.0:0** and use pool **default\_gateway\_pool**.*

## Setting the default gateway pool

If a Link Controller does not have a predefined route for network traffic, the unit automatically sends traffic to the pool that you define as the default gateway pool. Think of the default gateway pool as a pool of default routes.

In a Link Controller configuration, the default gateway pool must contain two or more gateway IP addresses, or ISPs. If a gateway in the default gateway pool becomes inactive, existing connections through the inactive gateway are routed through another gateway in the default gateway pool.

#### ◆ **Note**

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*If you configured more than one default gateway in the Setup utility, the Link Controller automatically created a **default\_gateway\_pool** pool.*

### To set the default gateway pool from the Configuration utility

1. In the navigation pane, click **System**.  
The System screen opens.
2. Click the Properties tab.  
The Properties screen opens.
3. From the **Default Gateway Pool** list, select the pool that contains the internal IP addresses of the gateway routers.  
In the example in this chapter, this is the **default\_gateway\_pool** pool.
4. Click **Apply**.

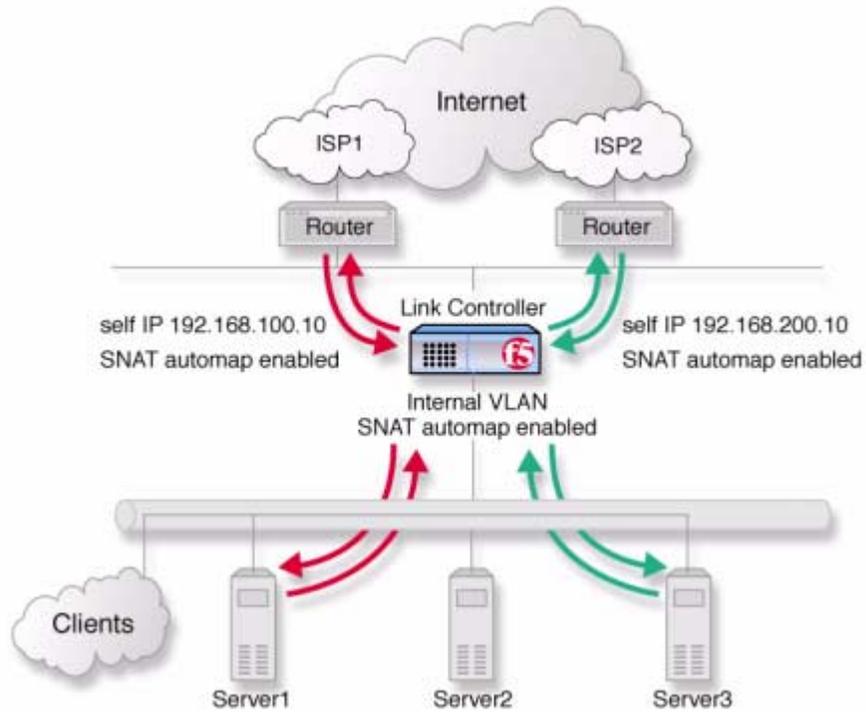
#### ◆ **WARNING**

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*Default gateway IP addresses must have corresponding self IP address/netmask combinations on the Link Controller.*

## Configuring SNAT automap for outbound traffic

You must now set up secure network address translation (SNAT) automap for outbound traffic so that clients receive replies through the same ISP that their requests originated from. Specifically, you must configure SNAT automap for each self IP address associated with a link on the Link Controller, and on each internal VLAN. Figure 4.3 is an example of the SNAT automap configuration for link load balancing.



**Figure 4.3** Enable the SNAT automap feature on self IP addresses and on internal VLANs

To set up a SNAT automap, you must enable SNAT automap for each of the self IP addresses, and on each internal VLAN.

### **To enable SNAT automap for each self IP address on the Link Controller**

1. In the navigation pane, click **Network**.  
The Network screen opens.
2. In the Network screen, click the Self IP Addresses tab.  
The Self IP Addresses screen opens.
3. In the Self IP address list, click a self IP address.  
The self IP address properties screen for that self IP address opens.
4. Check the **Enable SNAT Automap** box.
5. Click the **Apply** button.
6. Repeat steps 3 through 5 for each self IP address.

### **To enable SNAT automap on the internal VLAN**

1. In the navigation pane, click **NATs**.  
The NAT configuration screen opens.
2. Click the SNATs tab.  
The SNAT configuration screen opens.
3. Click the **Add** button.  
The Add SNAT screen opens.
  - For the Translation Address, click **Automap**.
  - In the Origin List section, select the internal VLAN from the **Origin VLAN** list and click the Add button (>>) to move it to the **Current List**.
4. Click the **Done** button.

## Adding a wide IP for inbound load balancing

To complete the link load balancing configuration, you must configure a wide IP and wide IP pool for each pair of virtual servers you created for each link. Each wide IP in your configuration has a pool of virtual servers that the Link Controller load balances incoming DNS requests to. The wide IP pool is made up of only virtual servers managed by the Link Controller. When you configure the wide IP pool, you specify the load balancing methods that the Link Controller applies to incoming DNS requests.

### To add a new wide IP in the Configuration utility

1. In the navigation pane, click **Wide IPs**.  
The Wide IP List screen opens.
2. On the toolbar, click **Add Wide IP**.  
The Add a New Wide IP screen opens.
3. Add the settings for the wide IP.  
For information about the specific settings, click **Help** on the toolbar.
4. Click **Next**.  
The Configure Load Balancing for New Pool screen opens.
5. Add the settings for the wide IP pool. Note that you should configure the following settings:
  - Set the preferred load balancing mode to **Quality of Service**.
  - Check the **Dynamic Ratio** box.
  - For information about the additional settings, click **Help** on the toolbar.
6. Click **Next**.  
The Select Virtual Servers screen opens.
7. Check all the virtual servers that should be in this wide IP pool. You should include a virtual server for each link in the pool.
8. Click **Finish**.  
The Wide IP List screen opens, and you see the newly-created wide IP in the list.

## Configuring cost values for each link

After you configure the wide IP, you can set the cost values you want the Link Controller to use when load balancing traffic for the links, based on the billing structure that your ISP uses. The Link Controller load balances traffic to another link if the lowest cost link reaches a threshold that you have set. This helps you control traffic based on the cost the ISP is charging for the bandwidth. The following tasks describe how to configure the cost values for the scenario shown in Figure 4.1.

### To configure the cost value for a link

1. In the navigation pane, click **Links**.  
The Link List screen opens.
2. In the Link List, click the name of the link you want to configure.  
The Modify Link screen for the link opens.
3. In the Cost Analysis table, you can configure the following cost elements associated with the link:
  - The Prepaid Segment section of the Cost Analysis table provides a place for you to type the maximum bandwidth usage you pay for each month, regardless of how much you use. In the example in this document, **ISP2** charges \$1000 for bandwidth usage in the 0 to 1.54 Mbps range. That means that you pay every month for up to 1.54 Mbps even if you do not use the link at all. So, using the example, you would type **1540** in the **Prepaid Segment, Up to Kbps** box.
  - In the Incremental Segment section of the Cost Analysis table, type the bandwidth (in Kbps) and the associated cost of the next pricing tier. Based on the example, **ISP2** charges \$2200 for bandwidth usage in the 1.54 to 3 Mbps range. Using this example, type **3000** in the **Up to Kbps** box and **2200** in the **Cost** box. Click the Add button (>>) to add the new cost tier to the configuration. You can add additional cost tiers to the configuration if required.
4. After you complete the configuration, click the **Update** button.

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### **WARNING**

*If you configure pricing for one link on the Link Controller, you must configure pricing for all of the remaining links in the configuration. If you do not, the Link Controller load balances only to the link for which pricing is defined.*

## Configuring link capacity limits for load balancing

In addition to setting cost values for the bandwidth usage on a link, you can set link capacity limits for the actual traffic on the link. When you set limits on the link bandwidth capacity, you can set independent thresholds for inbound, outbound, and concurrent total traffic. There are several configuration details to consider:

- You can moderate the volume of bandwidth used for outbound requests, that is, the traffic generated by users inside the firewall, by setting a limit on outbound traffic.
- If you purchase bandwidth based on tiered pricing, you may want to limit the total traffic to a data transfer rate that keeps the volume of bandwidth used at or below a certain level of the pricing tier.
- By setting link capacity limits, you can ensure that a link does not become completely saturated before the Link Controller marks the link as **unavailable** for new traffic.

### To set link capacity limits using the Configuration utility

1. In the navigation pane, click **Links**.  
The Link List screen opens.
2. Click the name of one of the links in the link list.  
The Modify Link screen for that link opens.
3. Add the limits in the **Bandwidth Limit** section of the **Link** table.
4. Click **Update** (near the bottom of the screen).  
For details on the specific settings on the Modify Link screen, click **Help** on the toolbar.

## Configuring transparent monitors for the links

When you create the default gateway pool, that process creates simple ICMP monitors that check to make sure the IP addresses in the default gateway pool are available to the Link Controller. In addition to the default ICMP monitors, you can configure transparent monitors that verify the path taken by traffic through each link. You can use transparent monitors to check the availability of a device in an ISP network or on the Internet.

### To configure a transparent monitor using the Configuration utility

1. In the navigation pane, click **Monitors**.  
The Monitors screen opens.
2. Click the **Add** button.  
The Add Monitor screen opens.
3. In the Add Monitor screen, type in the name of your monitor, for example **LinkMonitor** (it must be different from the monitor template name), and select the **tcp** monitor template.

4. Click the **Next** button.  
The Configure Basic Properties screen opens. The default **interval** and **timeout** values should be sufficient.
5. Click the **Next** button.
6. Check the **Transparent** box, and click the **Next** button.  
The Configure Destination IP and Service (Alias) screen opens.
7. In the **Destination IP** box, type the IP address of a network device on the other side of the router that you want to monitor.
  - If you are monitoring a device at the ISP, you should contact the ISP for more information about how to configure this monitor.
  - If you are monitoring a device in an ISP network, you must configure a separate monitor, with a specific IP and port combination for the device, for each ISP network.
  - If you are monitoring a device on the public Internet, you can create one monitor that is applicable for all links.
8. In the **Destination Service** box, type the service number you want to monitor. For example, if Telnet is enabled on the destination device, type **23**.

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◆ **Note**

*You can also set up ICMP transparent monitors. When your ISP does not allow TCP monitoring, use ICMP monitoring instead.*

### **To associate the monitor with the members of the default gateway pool**

After you create the monitors to check the availability of the links, you must associate the monitors with the routers in the default gateway pool.

1. In the navigation pane, click **Monitors**.  
The Monitors screen opens.
2. Click the Node Associations tab.  
The Node Association screen opens.
3. Choose the monitor you created to monitor links from the **Choose Monitor** list.
4. Click the Add button (>>) to move the monitor into the **Monitor Rule** box.
5. In the node list table, in the Associate Current Monitor Rule column, check the check box for each node address that is in the default gateway pool.
6. Click the **Apply** button.

## Monitoring link performance

After you complete the Link Controller configuration, you can monitor the performance of the links by using one or more of the following tools in the Configuration utility:

- Internet Link Evaluator
- Link Statistics screens
- Link Report screens

You can use the screens to analyze the traffic patterns in your network so that you can adjust the Link Controller configuration to best meet your link management objectives. The following sections describe the screens and how to view them.

### Working with the Internet Link Evaluator

The Internet Link Evaluator displays the average round trip times, the average completion rates, and the average router hops for the links in your configuration. You can use the Internet Link Evaluator to compare actual performance between links and between ISPs.

#### To view the Internet Link Evaluator

1. In the navigation pane, expand the **Link Statistics** item, and then click **Link Evaluator**.  
The Internet Link Evaluator screen opens.
2. For more information about interpreting the data on this screen, click the **Help** button on the toolbar.

### Working with the link statistics screens

The link statistics screens display current data for the physical and logical elements of the configuration. Each link statistics screen displays a particular aspect of your configuration.

#### To view the Link Statistics screens

1. In the navigation pane, expand the **Link Statistics** item, and then click one of the link statistics objects.  
The statistics screen for the object you selected opens.
2. For more information about a link statistics screen, click the **Help** button on the toolbar.

## Working with the Link Report screen

The Link Report screen displays performance graphs for three time intervals: 30 minutes, 6 hours, and 24 hours. The graphs illustrate the volume of inbound and outbound traffic over a link during the specified time interval. The graphs also indicate any bandwidth pricing levels you have set for a link. You can view a Link Report screen for all the links in the configuration, or for a particular link in the configuration.

### To view the Link Report screen for all links

1. In the navigation pane, expand the **Link Statistics** item, and then click **Links**.  
The Link Statistics screen opens.
2. Click the **Graph Link Summary** button.  
The Link Report for All Links screen opens, where you can review the bandwidth usage for all links in the most recent 30-minute, 6-hour, and 24-hour intervals.

### To view the Link Report screen for a particular link

1. In the navigation pane, expand the **Link Statistics** item, and then click **Links**.  
The Link Statistics screen opens.
2. Click the **Graph Link Detail** button for the link whose data you want to review.  
The Link Report screen opens, where you can review the bandwidth usage for the particular link in the most recent 30-minute, 6-hour, and 24-hour intervals.

## Additional configuration options

Whenever a Link Controller is configured, you have a number of options:

- You have the option in all configurations to configure a Link Controller redundant system for fail-over. Refer to Chapter 8, *Configuring a Redundant System*, in the **BIG-IP Link Controller Reference Guide**.
- All configurations have health monitoring options. Refer to *Health Monitors* in Chapter 2, *Configuring the High-Level Network*, in the **BIG-IP Link Controller Reference Guide**.
- When you create a virtual server pool, there is an option to set up persistence and a choice of load balancing methods. Refer to *Pools* in the Chapter 2, *Configuring the High-Level Network*, in the **BIG-IP Link Controller Reference Guide**.
- When you create a wide IP, you have a choice of load balancing modes. Refer to Chapter 5, *Inbound Load Balancing*, in the **BIG-IP Link Controller Reference Guide**.





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## Glossary

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**A record**

The **A** record is the ADDRESS resource record that a Link Controller returns to a local DNS server in response to a name resolution request. The **A** record contains a variety of information, including one or more IP addresses that resolve to the requested domain name.

**active unit**

In a redundant system, an active unit is a system that currently load balances name resolution requests. If the active unit in the redundant system fails, the standby unit assumes control and begins to load balance requests.

**alternate method**

The alternate method specifies the load balancing mode that the Link Controller uses to pick a virtual server if the preferred method fails. See also *preferred method*.

**Any IP Traffic**

Any IP Traffic is a feature that allows the Link Controller to load balance protocols other than TCP and UDP.

**big3d agent**

The **big3d** agent is a monitoring agent that collects metrics information about server performance and network paths between a Link Controller and a specific local DNS server. The Link Controller uses the information collected by the **big3d** agent for dynamic load balancing.

**bigpipe**

The **bigpipe** utility provides command line access to the Link Controller.

**BIG/stat**

BIG/stat is a statistical monitoring utility that ships on the Link Controller. This utility provides a snap-shot of statistical information.

**BIG/top**

BIG/top is a statistical monitoring utility that ships on the Link Controller. This utility provides real-time statistical information.

**BIND (Berkeley Internet Name Domain)**

BIND is the most common implementation of the Domain Name System (DNS). BIND provides a system for matching domain names to IP addresses. For more information, refer to <http://www.isc.org/products/BIND>.

**chain**

A chain is a series of filtering criteria used to restrict access to an IP address. The order of the criteria in the chain determines how the filter is applied, from the general criteria first, to the more detailed criteria at the end of the chain.

**completion rate**

The completion rate is the percentage of packets that a server successfully returns during a given session.

**Completion Rate mode**

The Completion Rate mode is a dynamic load balancing mode that distributes connections based on which network path drops the fewest packets, or allows the fewest number of packets to time out.

**default VLANs**

The Link Controller is configured with two default VLANs, one for each interface. One default VLAN is named *internal* and one is named *external*. See also *VLAN*.

**default wildcard virtual server**

A default wildcard virtual server has an IP address and port number of **0.0.0.0**, or **\*:\*** or **"any":"any"**. This virtual server accepts all traffic that does not match any other virtual server defined in the configuration.

**domain name**

A domain name is a unique name that is associated with one or more IP addresses. Domain names are used in URLs to identify particular Web pages. For example, in the URL **http://www.f5.com/index.html**, the domain name is **f5.com**.

**dynamic load balancing**

Dynamic load balancing modes use current performance information from each node to determine which node should receive each new connection. The different dynamic load balancing modes incorporate different performance factors such as current server performance and current connection load.

**dynamic load balancing modes**

Dynamic load balancing modes base the distribution of name resolution requests to virtual servers on live data, such as current server performance and current connection load.

**Dynamic Ratio load balancing mode**

Dynamic Ratio mode is like Ratio mode (see *Ratio mode*), except that ratio weights are based on continuous monitoring of the links and are therefore continually changing.

**external monitor**

An external monitor is a user-supplied health monitor. See also, *health check*, *health monitor*.

**external VLAN**

The external VLAN is a default VLAN on the Link Controller. In a basic configuration, this VLAN has the administration ports locked down. In a normal configuration, this is typically a VLAN on which external clients request connections to internal servers.

**fail-over**

Fail-over is the process whereby a standby unit in a redundant system takes over when a software failure or a hardware failure is detected on the active unit.

**fail-over cable**

The fail-over cable directly connects the two controller units together in a redundant system.

**Fastest mode**

Fastest mode is a dynamic load balancing mode that bases connection distribution on which server currently exhibits the fastest response time to node pings.

**FDDI (Fiber Distributed Data Interface)**

FDDI is a multi-mode protocol used for transmitting data on optical-fiber cables at speeds up to 100 Mbps.

**floating self IP address**

A floating self IP address is an additional self IP address for a VLAN that serves as a shared address by both units of a Link Controller redundant system.

**Global Availability mode**

Global Availability mode is a static load balancing mode that bases connection distribution on a particular server order, always sending a connection to the first available server in the list. This mode differs from Round Robin mode in that it searches for an available server always starting with the first server in the list, while Round Robin mode searches for an available server starting with the next server in the list (with respect to the server selected for the previous connection request).

**health check**

A health check is a Link Controller feature that determines whether a node is **up** or **down**. Health checks are implemented through health monitors. See also *health monitor* and *external monitor*.

**health monitor**

A health monitor checks a node to see if it is **up** and functioning for a given service. If the node fails the check, it is marked **down**. Different monitors exist for checking different services. See also *health check* and *external monitor*.

**host**

A host is a network server that manages one or more virtual servers that the Link Controller uses for load balancing.

**ICMP (Internet Control Message Protocol)**

ICMP is an Internet communications protocol used to determine information about routes to destination addresses, such as virtual servers managed by Link Controller systems.

**interface**

The physical port on a Link Controller is called an interface. See also *link*.

**internal VLAN**

The internal VLAN is a default VLAN on the Link Controller. In a basic configuration, this VLAN has the administration ports open. In a normal configuration, this is a network interface that handles connections from internal servers.

**IPSEC**

IPSEC (Internet Security Protocol) is a communications protocol that provides security for the network layer of the Internet without imposing requirements on applications running above it.

**iQuery**

The iQuery protocol is used to exchange information between Link Controllers. The iQuery protocol is officially registered with IANA for port 4353, and works on UDP and TCP connections.

**Kilobytes/Second mode**

The Kilobytes/Second mode is a dynamic load balancing mode that distributes connections based on which available server currently processes the fewest kilobytes per second.

**last hop**

A last hop is the final hop a connection took to get to the Link Controller. You can allow the Link Controller to determine the last hop automatically to send packets back to the device from which they originated. You can also specify the last hop manually by making it a member of a last hop pool.

**Least Connections mode**

Least Connections mode is a dynamic load balancing mode that bases connection distribution on which server currently manages the fewest open connections.

**link**

A link is a physical interface on the Link Controller connected to another physical interface in a network.

**link aggregation**

The link aggregation feature allows you to combine a number of links together to act as one interface.

**Link Controller active unit**

In a redundant system, the Link Controller active unit is the controller that currently load balances connections. If the active unit in the redundant system fails, the standby unit assumes control and begins to load balance connections.

**Link Controller web server**

The Link Controller web server runs on a Link Controller and hosts the Configuration utility.

**load balancing mode**

A load balancing mode is a particular method of determining how to distribute connections across links.

**local DNS**

A local DNS is a server that makes name resolution requests on behalf of a client. With respect to the Link Controller, local DNS servers are the source of name resolution requests. Local DNS is also referred to as LDNS.

**loopback adapter**

A loopback adapter is a software interface that is not associated with an actual network card. The nPath routing configuration requires you to configure loopback adapters on servers.

**MAC (Media Access Control)**

MAC is a protocol that defines the way workstations gain access to transmission media, and is most widely used in reference to LANs. For IEEE LANs, the MAC layer is the lower sublayer of the data link layer protocol.

**MAC address**

A MAC address is used to represent hardware devices on an Ethernet network.

**member**

Member is a reference to a node when it is included in a particular pool. Pools typically include multiple member nodes.

**metrics information**

Metrics information is the data that is typically collected about the paths between Link Controllers and local DNS servers. Metrics information is also collected about the performance and availability of virtual servers. Metrics information is used for load balancing, and it can include statistics such as round trip time, packet rate, and packet loss.

**MindTerm SSH**

MindTerm SSH is the third-party application on Link Controller systems that uses SSH for secure remote communications. SSH encrypts all network traffic (including passwords) to effectively eliminate eavesdropping, connection hijacking, and other network-level attacks. SSH also provides secure tunneling capabilities and a variety of authentication methods.

**minimum active members**

The minimum active members is the number of members that must be active in a priority group in order for the Link Controller to send its requests to that group. If the number of active members falls below this number, requests are sent to the next highest priority group (the priority group with the next lowest priority number).

**monitor**

The Link Controller uses monitors to determine whether nodes are **up** or **down**. There are several different types of monitors and they use various methods to determine the status of a server or service.

**monitor destination IP address or IP address:port**

The monitor destination IP address or address:port for a user defined monitor is used mainly for setting up a node alias for the monitor to check. All nodes associated with that monitor will be marked down if the alias node (destination IP address:port) is marked down. See also *node alias*.

**monitor instance**

You create a monitor instance when a health monitor is associated with a node, node address, or port. It is the monitor instance that actually performs the health check, not the monitor.

**monitor template**

A monitor template is a system-supplied health monitor that is used primarily as a template to create user-defined monitors, but in some cases can be used as is. The Link Controller includes a number of monitor

templates, each specific to a service type, for example, HTTP and FTP. The template has a template type that corresponds to the service type and is usually the name of the template.

**name resolution**

Name resolution is the process by which a name server matches a domain name request to an IP address, and sends the information to the client requesting the resolution.

**name server**

A name server is a server that maintains a DNS database, and resolves domain name requests to IP addresses using that database.

**named**

The **named** daemon manages domain name server software.

**NAT (Network Address Translation)**

A NAT is an alias IP address that identifies a specific node managed by the Link Controller to the external network.

**node**

A node is a specific combination of an IP address and port (service) number associated with a server in the array that is managed by the Link Controller.

**node address**

A node address is the IP address associated with one or more nodes. This IP address can be the real IP address of a network server, or it can be an alias IP address on a network server.

**node alias**

A node alias is a node address that the Link Controller uses to verify the status of multiple nodes. When the Link Controller uses a node alias to check node status, it pings the node alias. If the Link Controller receives a response to the ping, it marks all nodes associated with the node alias as **up**. If the controller does not receive a response to the ping, the it marks all nodes associated with the node alias as **down**.

**node port**

A node port is the port number or service name that is hosted by a specific node.

**node status**

Node status indicates whether a node is **up** and available to receive connections, or **down** and unavailable. The Link Controller uses the node ping and health check features to determine node status.

**Observed mode**

Observed mode is a dynamic load balancing mode that bases connection distribution on a combination of two factors: the server that currently hosts the fewest connections and also has the fastest response time.

**packet rate**

The packet rate is the number of data packets per second processed by a server.

**Packet Rate mode**

The Packet Rate mode is a dynamic load balancing mode that distributes connections based on which available server currently processes the fewest packets per second.

**path**

A path is a logical network route between a Link Controller and a local DNS server.

**path probing**

Path probing is the collection of metrics data, such as round trip time and packet rate, for a given path between a requesting LDNS server and a Link Controller.

**performance monitor**

A performance monitor gathers statistics and checks the state of a target device.

**persistence**

Persistence is a series of related connections received from the same client, having the same session ID. When persistence is turned **on**, a controller sends all connections having the same session ID to the same node, instead of load balancing the connections.

**picks**

Picks represent the number of times a particular virtual server is selected to receive a load balanced connection.

**pool**

A pool is composed of a group of network devices (called members). The Link Controller load balances requests to the nodes within a pool based on the load balancing method and persistence method you choose when you create the pool or edit its properties.

**pool ratio**

A pool ratio is a ratio weight applied to pools in a wide IP. If the Pool LB mode is set to Ratio, the Link Controller uses each pool for load balancing in proportion to the weight defined for the pool.

**port**

A port is represented by a number that is associated with a specific service supported by a host. Refer to the Services and Port Index for a list of port numbers and corresponding services.

**port-specific wildcard virtual server**

A port-specific wildcard virtual server is a wildcard virtual server that uses a port number other than 0. See *wildcard virtual server*.

**port mirroring**

Port mirroring is a feature that allows you to copy traffic from any port or set of ports to a single, separate port where a sniffing device is attached.

**Predictive mode**

Predictive mode is a dynamic load balancing mode that bases connection distribution on a combination of two factors: the server that currently hosts the fewest connections, and also has the fastest response time. Predictive mode also ranks server performance over time, and passes connections to servers which exhibit an improvement in performance rather than a decline.

**preferred method**

The preferred method specifies the first load balancing mode that the Link Controller uses to load balance a resolution request. See also *alternate method*.

**QOS equation**

The QOS equation is the equation on which the Quality of Service load balancing mode is based. The equation calculates a score for a given path between a link and a local DNS server. The Quality of Service mode distributes connections based on the best path score for an available link. You can apply weights to the factors in the equation, such as round trip time and completion rate.

**Quality of Service load balancing mode**

The Quality of Service load balancing mode is a dynamic inbound load balancing mode that bases connection distribution on a configurable combination of the packet rate, completion rate, round trip time, hops, virtual server capacity, kilobytes per second, and topology information.

**rate class**

You create a rate filter from the Configuration utility or command line utility. When you assign a rate class to a rate filter, a rate class determines the volume of traffic allowed through a rate filter. See also *rate filter*.

**rate filter**

Rate filters consist of a basic filter with a rate class. Rate filters are a type of extended IP filter. They use the same IP filter method, but they apply a rate class, which determines the volume of network traffic allowed through the filter. See also *rate class*.

**ratio**

A ratio is a parameter that assigns a weight to a virtual server for load balancing purposes.

**Ratio mode**

The Ratio load balancing mode distributes connections across an array of virtual servers in proportion to the ratio weights assigned to each individual virtual server.

**redundant system**

Redundant system refers to a pair of controllers that are configured for fail-over. In a redundant system, there are two controller units, one running as the active unit and one running as the standby unit. If the active unit fails, the standby unit takes over and manages connection requests.

**remote administrative IP address**

A remote administrative IP address is an IP address from which a controller allows shell connections, such as Telnet or SSH.

**resource record**

A resource record is a record in a DNS database that stores data associated with domain names. A resource record typically includes a domain name, a TTL, a record type, and data specific to that record type. See also *A record*.

**RFC 1918 addresses**

An RFC 1918 address is an address that is within the range of non-routable addresses described in the IETF RFC 1918.

**Round Robin mode**

Round Robin mode is a static load balancing mode that bases connection distribution on a set server order. Round Robin mode sends a connection request to the next available server in the order.

**round trip time (RTT)**

Round trip time is the calculation of the time (in microseconds) that a local DNS server takes to respond to a ping issued by the **big3d** agent running on a link. The Link Controller takes RTT values into account when it uses dynamic load balancing modes.

**Round Trip Time mode**

Round Trip Time mode is a dynamic load balancing mode that bases connection distribution on which virtual server has the fastest measured round trip time between the link and the local DNS server.

**self IP address**

Self IP addresses are the IP addresses owned by the Link Controller that you use to access the internal and external VLANs.

**service**

Service refers to services such as TCP, UDP, HTTP, and FTP.

**Setup utility**

The Setup utility is a utility that takes you through the initial system configuration process. The Setup utility runs automatically when you turn on a system for the first time.

**SNAT (Secure Network Address Translation)**

A SNAT is a feature you can configure on the Link Controller. A SNAT defines a routable alias IP address that one or more nodes can use as a source IP address when making connections to hosts on the external network.

**SNAT automap**

This feature allows the Link Controller to perform a SNAT automatically on any connection that is coming from the system's internal VLAN. It is easier to use than traditional SNATs and solves certain problems associated with traditional SNATs.

**SNMP (Simple Network Management Protocol)**

SNMP is the Internet standard protocol, defined in STD 15, RFC 1157, developed to manage nodes on an IP network.

**source processing**

Source processing means that the interface rewrites the source of an incoming packet.

**spanning tree protocol (STP)**

Spanning tree protocol is a protocol that provides loop resolution in configurations where one or more external switches is connected in parallel with the Link Controller.

**SSH**

SSH is a protocol for secure remote login and other secure network services over a non-secure network.

**SSL gateway**

An SSL gateway is a gateway for decrypting HTTPS requests to an HTTP server and encrypting the reply.

**standby unit**

A standby unit in a redundant system is a unit that is always prepared to become the active unit if the active unit fails.

**state mirroring**

State mirroring is a feature on the Link Controller that preserves connection and persistence information in a Link Controller redundant system.

**static load balancing modes**

Static load balancing modes base connection distribution on a pre-defined list of criteria and virtual server availability; they do not take current server performance or current connection load into account.

**sticky mask**

A sticky mask is a special IP mask that you can configure on the Link Controller. This mask optimizes sticky persistence entries by grouping more of them together.

**tagged VLAN**

You can define any interface as a member of a tagged VLAN. You can create a list of VLAN tags or names for each tagged interface.

**transparent node**

A transparent node appears as a router to other network devices, including the Link Controller.

**trunk**

A trunk is a combination of two or more interfaces and cables configured as one link. See also *link aggregation*.

**unavailable**

The **unavailable** status is used for links and virtual servers. When a link or virtual server is **unavailable**, the Link Controller does not use it for load balancing.

**unknown**

The **unknown** status is used for links and virtual servers. When a link or virtual server is new to the Link Controller and does not yet have metrics information, the Link Controller marks its status as **unknown**. The Link Controller can use unknown servers for load balancing, but if the load balancing mode is dynamic, the Link Controller uses default metrics information for the unknown server until it receives live metrics data.

**up**

The **up** status is used for links and virtual servers. When a link or virtual server is **up**, the link or virtual server is available to respond to process connections.

**user-defined monitor**

A user-defined monitor is a custom monitor configured by a user, based on a system-supplied monitor template. For some monitor types, you must create a user-defined monitor in order to use them. For all monitor types, you must create a user-defined monitor to change system supplied monitor default values.

**virtual address**

A virtual address is an IP address associated with one or more virtual servers managed by the Link Controller.

**virtual port**

A virtual port is the port number or service name associated with one or more virtual servers managed by the Link Controller. A virtual port number should be the same TCP or UDP port number to which client programs expect to connect.

**virtual server**

Virtual servers are a specific combination of virtual address and virtual port, associated with a content site that is managed by a Link Controller or other type of host server.

**VLAN**

VLAN stands for virtual local area network. A VLAN is a logical grouping of network devices. You can use a VLAN to logically group devices that are on different network segments.

**VLAN name**

A VLAN name is the symbolic name used to identify a VLAN. For example, you might configure a VLAN named **marketing**, or a VLAN named **development**. See also *VLAN*.

**watchdog timer card**

A watchdog timer card is a hardware device that monitors the Link Controller for hardware failure.

**wide IP**

A wide IP is a collection of one or more domain names that maps to one or more groups of virtual servers managed either by Link Controller systems, EDGE-FX Caches, or by host servers. The Link Controller load balances name resolution requests across the virtual servers that are defined in the wide IP that is associated with the requested domain name.

**wildcard virtual server**

A wildcard virtual server is a virtual server that uses an IP address of **0.0.0.0**, \* or "**any**". A wildcard virtual server accepts connection requests for destinations outside of the local network. Wildcard virtual servers are included only in Transparent Node Mode configurations.



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