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Tom Badgett
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***Business Internet
Access Optimization***

FOR

DUMMIES®

CUSTOM EDITION

**by Tom Badgett, Corey Sandler,
and Jean Pascal (JP) Hébert**



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Introduction

The Internet as we know it has been around for just the past 15 years or so; it was in use in labs and government installations for another decade or so before then.

In that short period of time, it has come to permeate our personal and business existence. It connects us with our customers and suppliers, our banks, friends, and family. The Internet is a repository for a fantastic collection of knowledge, commerce, and the nuts and bolts of daily life.

How would our lives change if it went away?

The unfortunate fact is, for most of us the Internet is unavailable more often than you think. And for businesses that depend on full time, high-speed connectivity, any downtime at all can be costly.

Even a momentary interruption of your Internet connection can drop a VPN session, causing service failures to remote branch users. A file transfer in progress when the Internet link breaks can force a restart or worse, cause data loss. If you're using VoIP (Voice over Internet Protocol) for your corporate telephone or teleconferencing, broken network links are unprofessional, irritating, and counterproductive.

About This Book

When you enter a dark room and reach for the light switch, do you wonder whether the light will come on? Of course you don't. Power outages do occur, of course, but over a hundred years of infrastructure evolution means power losses are rare.

We've come to think of the Internet in the same way, as a utility that is always there. It is easy to take Internet bandwidth and uptime for granted, even in a corporate environment. And, the truth is, your Internet connection probably is there for you most of the time.

However, it also is true that it takes a lot of planning and preparation to keep it that way. To keep your business running smoothly you need to optimize bandwidth and maximize uptime.

Business Internet Access Optimization For Dummies is your guide to ensuring that your critical Internet access stays up and stays fast all day every day. You'll learn why and how to use Internet link balancing and alternative ISP (Internet Service Provider) technologies to improve Internet bandwidth and uptime.

Foolish Assumptions

In writing this book, we've made some assumptions about you. We assume that you're

- ✓ In business and depend on reliable, high-speed Internet connections to support your operations.
- ✓ An IT manager, line-of-business manager, or business executive who needs to understand how to ensure that your Internet link is as fast and as dependable as possible.

How This Book Is Organized

Business Internet Access Optimization For Dummies is divided into five concise and information-packed chapters. You can dip in and out of this book as you like, or read it from cover to cover — it shouldn't take you long!

Chapter 1: Considering Internet Access Issues

Here we describe the computing environment we're most concerned with and point to some interesting statistics that will get you thinking.

Chapter 2: Addressing Basic Connectivity Issues

This is a ‘first steps’ discussion — the important things you should do first to launch your Internet optimization efforts. This chapter shows you the fundamentals of improving Internet reliability and bandwidth.

Chapter 3: Optimizing Internet Speed and Quality of Service

Once you have achieved the basics, it is time to step a little deeper into the topic of Internet optimization. Here we detail how to balance inbound and outbound connections, steps to improving quality of service, inter-site resiliency, network geo-balancing, and more.

Chapter 4: Introducing Elfiq Networks

Elfiq is one company that supplies network link balancing solutions. We use some details about their products to present more information on how link balancing works and how you design and implement it.

Chapter 5: The Part of Tens

This is our chance to bundle into a small package the top ten key concepts we think you need to keep at the front of your mind as you work on optimizing Internet bandwidth and uptime.

Icons Used in This Book

To make it even easier for you to navigate to the most useful information, we use the following icons:

4

Business Internet Access Optimization For Dummies



The Tip icon draws your attention to time- or money-saving advice.



The Remember icon highlights important information to bear in mind.



The Example icon indicates real-life anecdotes to illustrate a point.

Chapter 1

Considering Internet Access Issues

.....

In This Chapter

- ▶ Understanding the business-Internet relationship
 - ▶ Facing downtime costs
 - ▶ Evaluating connection quality
 - ▶ Glancing at alternate connection technologies
-

Before we go forward to talk about today's access issues, we want to look the other direction for just a moment. Consider the Internet around about 1994.

If you'd asked people, "How do you use the Internet?" perhaps 95 percent would've answered, "Inter-what?" Some may have been vaguely aware of a stirring on the horizon, but the vast majority wouldn't have had a clue.

But 1994, as it turns out, was an important year in the evolution of the Internet as it moved toward becoming an absolute necessity in the world of business (and just about every other part of our lives). It was in that year that a pair of smart guys, Dr. Bill Pierce and Dr. Don Altman (then with Visualogic, Inc., an early service provider), wrote a short document to show businesses how to use the Internet.

We believe we're safe in saying that all businesses that use the Internet today are using all of Dr. Pierce's and Dr. Altman's suggestions, and a whole lot more. Back in 1994, when the World Wide Web and graphical user interfaces were hardly developed at all, these concepts were interesting suggestions. Today, they're necessities.

Investigating Business Connectivity Dependence

To fully understand the importance of the Internet to your business, you need to look at the experience from both sides: the company's side and your customers' side. At the very least, your business Internet connection helps create and maintain a corporate image, presents your product or service to a broad — even a global — audience, and improves intra-company communication.

From the customers' perspective, your Internet presence helps them find, understand, and compare your product or service, provides quick access to customer service, and perhaps supports online commerce.

Statistics gathered by Internet World Stats (www.internetworldstats.com) show more than 30 percent of the world's population was an Internet user during the first quarter of 2011. For North America alone, the figure is more than 78 percent. This data represents a 480 percent growth rate worldwide since 2000, and a 152 percent change for North America. The Internet is the vital blood system for corporate information interchange, and helps companies to achieve a competitive edge.

Consider these observations by IBM (from *Online Commerce White Paper*, October 2011) that caused the company to reevaluate and revamp its online commerce capabilities:

- ✔ IT buyers are becoming more willing to buy high-value, complex products and services electronically.
- ✔ Companies increasingly are adopting online purchasing strategies, and in some cases are mandating that suppliers use them.
- ✔ Online purchasing technology is more reliable, affordable, and accessible than ever before.

The result of this new focus? A 40 percent increase in direct business with IBM via online commerce in the first quarter of 2011. Moreover, clients report cost and time savings with the expanded online purchasing capabilities.

Blast from the past: Reasons for your business to use the Internet in 1994

Here are some benefits of using the Internet to promote your business back in 1994. They're all still applicable today:

- ✓ Reach a worldwide audience
- ✓ Provide product information
- ✓ Save on literature costs
- ✓ Augment or replace phone banks
- ✓ Provide easy access to customer service representatives
- ✓ Level your customer service load
- ✓ Inexpensively create or augment your corporate image
- ✓ Recruit new employees
- ✓ Offer useful information to attract customers
- ✓ Provide your services online
- ✓ Give customers access to searchable information
- ✓ Help customers understand why they need you
- ✓ Let customers try a sample of your product or service
- ✓ Eliminate the middleman
- ✓ Sell your products online
- ✓ Create an intranet for internal employee communication

Source: Pierce and Altman, as quoted on www.skipechert.com.

Considering the Fragility of Networks

Internet connectivity has become a business utility. Most managers, salespeople, and customer service personnel don't think about it any more than they think about whether their cars will start to carry them to work. Your IT staff thinks about your Internet connection all the time. They know its value, and they know it can be a fragile commodity.



According to a national survey by IT systems integrator CDW, released March 22, 2011, fully 25 percent of U.S. enterprise IT systems suffered unplanned outages of four hours or more in 2010. The cost to these businesses was billions of dollars in profits. Power outages were the primary cause of the interruptions, while hardware failures accounted for 29 percent and

loss of telecom services for another 21 percent. About 57 percent of the respondents reported productivity losses as the main negative effect of the network outage.

The cost of an Internet connection outage depends on how your business uses the Internet. When calculating costs, consider the salaries of employees who can't do their jobs when the Internet is down. Also figure in lost online sales based on average revenue per hour. Other costs, such as the loss of customer satisfaction and damage to the corporate image, are difficult to measure — but they certainly exist.



Doubtless most corporate data centers have some form of redundant power — generators, uninterruptible power supplies — and redundant hardware for at least some of their critical applications. The next step is to plan for redundant telecom and Internet connections.

Voicing Bandwidth and Uptime Concerns

Not only can your Internet link disappear completely, but it also can be compromised by slowdowns.

How do you know if you're getting full speed out of your *Internet service provider (ISP)* (the company that provides your Internet access)? You may be able to get general statistics from your provider, but few will give you any really meaningful data. So, run your own tests regularly.

One useful online tool is Speedtest (www.speedtest.net). You can check the upload and download speeds from your location to various servers around the world. Running tests such as this regularly and at different times of the day helps build an overall picture of your Internet connection quality.

If your connection speed isn't what you'd expected, consult your ISP and also test in-house links for slowdowns. By transferring large files of a known size across various network routes inside your enterprise, you can determine if you're getting full performance out of your *local area network (LAN)* — a network that interconnects computers in a limited area. In addition,

study your firewall logs and other WAN-based logs such as those from content and URL filtering tools (see Chapter 4). Moreover, listen to anecdotal evidence from your users. If network operations just “seem slow,” they probably are, either because of a problem with an individual computer saturating a link with huge transfers or because a network link isn’t up to par.

To reduce the potential impact of network outages or slowdowns, consider these points now and on a periodic basis:

- ✔ **Understand the costs and the consequences.** Knowing the cost of each type of outage or data loss will help you set priorities in your prevention planning or in your action plan for when an outage occurs.
- ✔ **Monitor your links and network usage.** Do you really know what your bandwidth usage and uptime is? Is your ISP doing unscheduled maintenance during the night, causing outages? Analyze server and router equipment, and upgrade if necessary. Consider adding redundant equipment and Internet access routes.
- ✔ **Protect Ethernet links and equipment.** Use surge protection on all power supply lines and communications links.
- ✔ **Protect Your Power Sources.** Use uninterruptible power supplies for servers and routers; consider redundant server power supplies.

Exploring Emerging Technology

Although Internet connection speed is important, there’s more to business Internet access optimization than speed. You need a constant connection. As we discuss earlier in this chapter, Internet outages and slowdowns can be quite expensive.

To protect your data and ensure a continuous Internet connection, consider some newer technologies that can help. For example, use cloud computing, as appropriate, for application delivery as well as data backup and delivery (see Chapter 3 for more on cloud computing). And for connection insurance, think about augmenting your dedicated lines with high-speed

cellular links, or small and medium business-grade DSL and cable connections. These backup connections won't offer service-level agreements (SLAs) or guaranteed quality of service (QoS), but the cost is reasonable and they provide a level of redundancy that can keep you on the air when your dedicated line goes down. (See Chapter 2 for a rundown of all your connection options.)

Chapter 2

Addressing Basic Connectivity Issues

.....

In This Chapter

- ▶ Helping your business survive
 - ▶ Looking at bandwidth issues
 - ▶ Considering alternative Internet Service Provider (ISP) technologies
-

In how many ways does your business depend on the Internet? Can you calculate the cost of an Internet outage or slowdown, minute by minute and application by application? Have you considered — really, seriously considered — reliable and cost-effective ways to reduce or eliminate Internet downtime? Need proof of the value of keeping your Internet connection alive? Try this simple test: Disconnect your Internet link at the office at 9 a.m. and then try to survive through the next hour!

In this chapter, we have a serious discussion about the serious business of helping your business survive by designing a network with multiple ISP connections for Internet redundancy.

Achieving Business Survivability

The main problem with ensuring all-the-time Internet uptime is that so many possible places for failure exist. But before considering that, consider this: How much thought have you given to the real cost of connection failures?

For example, would you feel pretty good about your corporate Internet connection technology if you knew it's 99.5 percent

reliable? That sounds good, but if your Internet is down only 0.5 percent of the time, that's nearly two full days of downtime, or about 44 hours a year — that is, if you really are averaging 99.5 percent uptime, all the time. Otherwise, you'll lose an additional eight or more hours for each 0.1 percentage point your average falls below 99.5 percent uptime.

Moreover, when do these outages occur? For many businesses, the Internet is a 24-hour customer resource. A brief outage during a credit card transaction, when using a virtual private network for critical business, when transferring data, or during a *voice over Internet Protocol* (VoIP) call (a “telephone” call that's made over the Internet) can be costly.



Even if you conduct regular bandwidth tests with your own equipment or through a service such as Speedtest (refer to Chapter 1 for more information), you may not capture information about periodic, small outages. The most common testing procedures only tell you how fast your connection is at the time of the test but no information on the stability of the ISP link.

The reasons for Internet outages are varied:

- ✓ Human error or system maintenance
- ✓ On-premise hardware or software failures
- ✓ Physical carrier network interruptions through equipment failure or physical damage
- ✓ Power interruptions
- ✓ Weather-related outages

As much as 32 percent of network outages may be caused by power outages, according to a 2010 industry survey. Hardware failure came in second at 29 percent, and loss of telecom services to facilities accounted for 21 percent of the downtime. (For more on this survey, refer to Chapter 1.)

One easy preventative measure is designing backup power systems for key networking equipment. You also need redundant hardware in key positions: servers, routers, and modems.



Expensive outages can happen despite a company's best efforts. Time Warner Cable and RCN, two cable Internet providers, experienced outages in 2011 that took down Internet connections for customers from Boston to Philadelphia. Although 'officially' the cause was 'unknown,' the most probable cause was the failure of a router that was handling key Internet traffic routes.

You can spend a lot of money and time designing a system to give you full information about Internet speed and every moment of uptime and downtime. However, you can pretty much ensure 100 percent Internet uptime for full-time business access and give your business a survivability edge with reasonable cost and effort.

How? Make sure you have redundant power and in-house connectivity hardware. Then design for connection redundancy and multiple ISP technologies. These steps provide virtually 100 percent Internet reliability and have an added benefit of giving your business increased Internet bandwidth at a reasonable cost. And when such a project is finished, it pays for itself within a year because downtime is a thing of the past.

Augmenting Internet Bandwidth

Back in the dark ages of the Internet (you know, the early 1990s), before graphical user interfaces were common, a single T1 line at 1.5 Mbps (megabits per second) could support an ISP with thousands of users. Today, most home Internet connections provide ten times that bandwidth, and even 30 to 100 Mbps connections for home use aren't uncommon.

For business Internet success, faster certainly is better. And the good news is, commercial high-speed Internet access costs have fallen during the past few years, so achieving very fast Internet access for your business can be cost-effective.

Most ISPs offer connectivity based on copper wire and fiber-optic networks that are widely deployed virtually everywhere and owned by the telephone companies. This includes the most common link technologies, such as *digital subscriber lines* (DSL), T1, and DS3.



The core of your business Internet access should be via high-speed, commercial-grade connections that include *service-level agreements* (SLAs) — contracts between you and each of your network service providers that specify, usually in measurable terms, what services the provider will furnish. At the same time, consider augmenting your commercial-grade connections with lower-cost, *small-to-medium-business-grade* (SMB-grade) links. Cable Internet or DSL, for example, offer reasonably high-speed Internet service at very reasonable rates. One or more SMB-grade connections can help ensure that your business will never be completely without access to the Internet.

Read on for more suggestions on ways to augment Internet bandwidth while providing connection redundancy, all at a reasonable cost.

Looking for Alternative ISP Technologies

When you know your job is to ensure that your employees and customers always have access to high speeds, reliable Internet, and online services, it's easy to assume that only the best will do. Then when complaints arrive about slow connections, corrupt data transfers, or lost links, your first thought is to secure another commercial link — and then your second thought may be, “But what about the cost?”

In this section, we offer some viable, and maybe unconventional, solutions for providing redundant Internet links to enhance speed and help ensure uninterrupted service. If you haven't considered alternative ISP technologies before, you may be surprised at the cost-benefit gains that are possible.

Considering cost versus performance

Consider first the mainstay of business Internet connections: leased lines. Depending on your business requirements, you may connect to a local ISP with one or more T1 lines (at 1.544 Mbps

each) or DS3 lines (at 45 Mbps), or perhaps a fiber connection (5 to 20 Mbps, or more). Your carrier can bond T1 or DS3 lines to add bandwidth, but you probably won't get a price advantage and you won't have achieved ISP redundancy.

Certainly you'll want at least one commercial-grade link through a carrier and ISP that understands and supports critical business operations. When it comes to enhancing bandwidth for peak usage times and providing redundant Internet connections, SMB-grade technologies may work just fine.

As you can see from Table 2-1, the cost savings can be considerable. The upload and download speeds in this table are the maximum normally available. In many cases you can purchase fractional speeds, and the maximum speed may not be available at all locations. Rural sites, for example, frequently suffer from poor quality because of older transport media.

Cost, of course, will vary with location and speed and in conjunction with other services you may be purchasing from your carrier or ISP.

<i>Technology</i>	<i>Down (Mbps)</i>	<i>Up (Mbps)</i>	<i>Monthly Cost Range</i>	<i>Cost/Mbps (Median Cost and Speed)</i>
T1/DS1	1.544	1.544	\$212–\$1,200	\$320
T3/DS3	45.0	45.0	\$2,000–\$14,000	\$300
ADSL	6.0	0.768	\$40–\$60	\$5
ADSL2	12.0	1.0	\$70–\$150	\$4
ADSL2+	24.0	3.3	\$100–\$200	\$3
Cable	250.0	15.0	\$40–\$300	\$3
Satellite	6.0	1.5	\$100–\$1,000	\$158
3G	14.4	5.8	Prices vary*	Prices vary*
4G	100.0	50.0	Prices vary*	Prices vary*
Fiber	100.0	100.0	\$1,000+	\$10+

(continued)

Table 2-1 (continued)

<i>Technology</i>	<i>Down (Mbps)</i>	<i>Up (Mbps)</i>	<i>Monthly Cost Range</i>	<i>Cost/Mbps (Median Cost and Speed)</i>
Wireless Internet service provider (WISP) (public broadcast)	10.0	10.0	\$65–\$250	\$20
Broadband wireless Internet access (BWIA) (point to point)	1,400.0	1,400.0	Prices vary**	Prices vary**
Utility-based ISP (BPL)	100.0	100.0	Prices vary**	Prices vary**

*See the section on 3G in “Running through your options,” later in this chapter.

**See the section on BWIA in “Running through your options,” later in this chapter.

Note: The prices and specifications in Table 2-1 are representative and will change over time. They were valid at the time we wrote this book. Calculations are based on median speed and cost. Bandwidth and cost vary with location.

Hybrid solutions also exist for some of these technologies. You can bond copper lines, for example, to provide faster speeds with slower technologies such as T1s or DSLs.

Ethernet over copper (EoC) is another alternative that uses existing telco lines. Sometimes called long-range Ethernet (LRE), a single EoC line pair can supply 15 Mbps to as much as 25 Mbps, or 30 to 50 Mbps for two pair, for example. Ethernet can also be supplied over fiber, which may support higher speeds but may require additional installation costs.



When we discuss data transfer speeds, we're talking about the capability of a given technology. When you use any of the technologies we mention to connect to the Internet, your actual throughput depends on the remote services you're accessing.

Running through your options

The following list summarizes the bandwidth and connection options you can use as primary or secondary links to the Internet.

T1/DS1

Pros: Established, reliable technology. Uses existing copper lines. Carrier SLA. Symmetrical service.

Cons: Slow by today's standards. Comparatively expensive, considering price and performance. Interface equipment may also be expensive.

T3/DS3

Pros: Better speed than with T1. Uses existing copper lines. Carrier SLA. Better price-to-performance ratio than with T1. Symmetrical service.

Cons: Comparatively expensive. Interface equipment may be expensive.

ADSL

Pros: Relatively inexpensive. Widely available. Uses existing copper lines.

Cons: Slow upload speeds compared to other technologies. Asymmetrical service. Performance can vary with physical line quality and the distance from the provider's exchange. Large static IP address pools may be difficult to obtain or may be very expensive. Check with your provider to understand availability and cost.

ADSL2/2+

Pros: Relatively inexpensive. More speed than with ADSL. Uses existing copper lines. Supports port bonding for increased speed.

Cons: Same as with ADSL.

Cable

Pros: High speeds. Very cost-effective. Widely available from multiple suppliers.

Cons: Speed can vary with usage. Asymmetrical service. Large static IP address pools may be difficult to obtain or may be very expensive. Check with your provider to understand availability and cost.

Satellite

Pros: Available virtually anywhere. No physical lines required.

Cons: Slowest of all of the alternatives. Signal latency may interfere with VoIP or other IP services. May be susceptible to weather conditions. Comparatively expensive for available bandwidth.

3G

Wireless service. Note that many providers are phasing out 3G air cards in favor of 4G cards. Prices and specifications are based on 4G service, but you may experience a downgrade to 3G if you're in a 3G-only area.

Pros: Widely available. Reasonably cost-effective. Likely to be available during power- or weather-related outages.

Cons: Slow compared to 4G. Static IP addresses usually aren't available. Quality of access depends on the distance from the cell antenna and the number of concurrent users connected to the cell tower.

4G

Available speed depends heavily on location and provider. This technology design supports symmetrical access speeds up to 1.5 Gbps; however, 5 to 20 Mbps is pretty much the standard offering. A few providers in key locations are promising 45 to 100 Mbps service at prices up to about \$3,000 per month.

Pros: Good speed. Reasonably cost-effective. Static IP addressing may be available, depending on the provider. Likely to be available during power- or weather-related outages. Symmetrical service.

Cons: May not be widely available, but that situation is changing. Static IP addresses usually aren't available. Quality of access depends on the distance from the cell antenna and the number of concurrent users connected to the cell tower. Most providers price this service based on monthly bandwidth usage. If you use more than allotted, cost can be prohibitive.



Despite the potential for 4G technology, actual performance at this time is much less than expected. A study by *PCWorld* magazine (March 2011) shows you can expect 3 to 6 Mbps download speeds and 1 to 5 Mbps upload speeds in the real world.

Fiber

High-speed public or private Internet access. Includes Ethernet over fiber. Mostly a commercial service, but some providers offer SMB-grade fiber connections for Internet and entertainment connections. If such service is available in your location, it can provide a low-cost, high-speed connection for your alternate connections.

Pros: Very high speeds. Large number of options. Reliable. Carrier SLA. Symmetrical commercial service, asymmetrical for SMB-grade service.

Cons: Not universally available. Can be expensive, compared to other options. May require fiber installation. Requires skilled installation and special interface equipment (such as a router with a small form-factor pluggable (SFP) port, which is widely available but more costly).

Wireless Internet service provider (WISP)

Wireless Internet access for a town or community. A publically available SMB-grade service. Widely available, especially in rural communities and downtown areas of cities.

Pros: Provides an alternate access medium (bypasses in-ground copper or fiber). Reasonable speeds and costs. Usually point-to-multipoint service, though some WISP companies may offer dedicated point-to-point connections.

Cons: May be affected by weather. Relatively short-distance links (last-mile coverage).

Broadband wireless Internet access (BWIA)

High-speed, point-to-point wireless for a company (or an individual with enough money). A leased, private, business-grade service. Point-to-point wireless is a good way to provide redundant connectivity for the last mile of your Internet link. (See Chapter 3 for an explanation of last-mile coverage.) This also can be a long-range solution (20 to 40 miles) to service remote locations. You can lease equipment and Internet access, or you can purchase equipment that links to a conventional carrier or ISP. Either way, you must pay for monthly Internet service from your carrier of choice.

Pros: High-speed access. Long ranges (up to 40 miles) are possible. Bypasses in-ground copper or fiber. Commercial-grade service. Carrier SLA.

Cons: Relatively expensive. Requires special equipment. May be affected by weather.

Utility-based ISPs

In some areas, other types of businesses piggyback Internet services with their primary services. For example, utility companies, such as natural gas suppliers, may use their existing ditches and road-to-home connections to offer copper or fiber Internet services. Prices and speeds are comparable to other similar services listed here, and the technology is the same as with telco-provided services.

A particular type of utility service is *broadband over power line* (BPL), where Internet access is carried over an electric utility's high-voltage power lines. Current ISP offerings generally measure around 3 Mbps, but some companies claim technology that is capable of 80 Mbps.

Pros: Uses some existing infrastructure. Reasonably high speeds.

Cons: Not widely available. In the case of BPL, may require outside interface-to-premises wiring, which may be a wired interface at the perimeter transformer or wireless access from an outside power pole. Limited high-speed technologies can bridge transformers without additional equipment. Also, BPL can cause interference to other radio frequency services, such as two-way communications, and for this reason may be regulated or banned in some areas.

Chapter 3

Optimizing Internet Speed and Quality of Service

In This Chapter

- ▶ Understanding your bandwidth needs
 - ▶ Getting to know about link balancing
 - ▶ Computing in the cloud
-

In computers, as in much of life, sooner or later everything old is new again. This is certainly true when we consider the idea of interconnected computers.

Back in the day, we used to work on dumb terminals tied to a central computer. Personal computers set us free of centralized control.

And then we figured out there really is value in central storage and computer-to-computer networking. As soon as we reconnected everything with local area networks (LANs), along came *wide area networks* (WANs) — telecommunication networks that cover broad areas.

The wide area network today, of course, is the Internet. We depend on it heavily, but many businesses struggle constantly to ensure availability and adequate speed. Luckily, procedures and technology exist to help, and that's what we're talking about in this chapter.

Building Smarter WAN Connectivity

Work smarter, not harder. Good advice, whatever the endeavor. Building smarter WAN connectivity also makes sense. You'll get better Internet performance and fewer headaches. Read this section to find a collection of smart ideas that can help you achieve the goal of having a smarter WAN.

Understanding bandwidth and application demographics

Before you start any project, you need to know where you're going. Smarter WAN connectivity begins with understanding WAN demographics: who is using your WAN link *now*, and what they're doing with it, plus who *will be* using your WAN, and why.

Different locations with different job responsibilities, for example, may have unique bandwidth and uptime needs. E-mail is important, but a few seconds of occasional downtime isn't a critical concern. Your voice over Internet Protocol (VoIP) phone system, on the other hand, can't stand interruptions, nor can you afford to have a critical virtual private network (VPN) drop its connection.

To ensure resilient connections and adequate bandwidth, you'll want to put heavy-duty resources where they're really needed and where they're the most cost-effective.

Designing for failover

Bandwidth is important, but keeping your Internet link live trumps bandwidth needs. To ensure full uptime, you need uninterruptible power supplies for routers, modems, firewalls, and servers. And you need at least two independent routes to the Internet for each location — this means using different technologies or different carriers, or both, for your various connections.

Here are the most common types of Internet failure:

- ✔ **Single-carrier link failure:** If you have only one Internet carrier link and it goes down . . . well, the result of that is pretty obvious, isn't it?
- ✔ **Multiple-carrier link failure:** A manual failover process, a lack of redundant equipment, or shared ISP lines, conduits, or termination points can cause even redundant links to fail simultaneously. Plus, expect downtime while reconfiguring network equipment to use the backup ISP.
- ✔ **Carrier link saturation:** Poor bandwidth-usage planning or a lack of formal and well-planned usage policies can cause problems from link overload.

No two situations are the same, but here are some things to consider: Make sure that different carriers aren't using the same copper or fiber. Have at least two connections that arrive from different sides of your facility, and in different ditches or on different poles, whenever possible. Otherwise, a construction mishap can take out your primary supplier and your redundant supplier at the same time.



Even if you purchase bandwidth from different carriers, in many areas they cooperate in providing the final leg of connection to your facility — the *last-mile* connection, as it is called. Research the physical path of each connection from all carriers to make sure you have at least two independent delivery routes.

Because hardware failures are always a possibility, consider using redundant equipment at critical locations. If your link balancing solution doesn't use firmware switching, you may also need to install software that knows when a hardware failure occurs and then move traffic from a malfunctioning device to one that's working.

An intelligent link balancer (see the next section for more information) can monitor each ISP link and stop using an extremely slow or nonfunctioning link. This automatic switching helps maintain maximum uptime by eliminating repeated attempts to use a dysfunctional link.

Introducing Link Balancing

Suppose you have two or more Internet connections, maybe even multiple technologies. You have both links working. But how do you control where your network traffic goes, and what do you do if one of these connections drops out? You can manage these issues to some extent with creative router programming using Border Gateway Protocol (BGP), for example. But you'll find that a dedicated link balancer is an easier, more affordable, and more efficient solution.



Even if you have multiple links to the Internet, a number of factors can cause outages, including damaged lines, link saturation, equipment defects, and routing or provisioning errors. Link saturation is particularly serious because it may result in a link that appears to be functioning but is too slow to be useful.

Link balancers do what their name implies. They allow you to connect multiple carriers and, in the best designs, multiple technologies, and then automatically manage traffic load on each link. In the event of a link failure, traffic is switched virtually seamlessly to the remaining link or links.

Intelligent link balancing can interpret link quality and make decisions on the fly as to where to send critical business data to maintain maximum uptime.

A good multi-ISP, multi-technology policy is cost-effective. For example, a single T1 line provides a reliable, carrier-supported connection but only 1.544 Mbps of bandwidth at a cost of \$350 or more, depending on where you are and what other services you may be purchasing from the same carrier. You could add three DSL lines and three modems for an initial investment of less than \$300 and recurring monthly costs of about \$150 in many locales. (Of course, specific prices differ in different locations and change over time.)

For less than half the cost of a single T1 link, you can get perhaps 18 Mbps of download bandwidth and 1.5 Mbps or more uplink bandwidth. In many locations, a monthly expenditure of \$350 — equivalent to a single T1 — can provide 72 Mbps of download speed and 4 Mbps of upload speed with three ADSL2+ lines. (For a breakdown of all your connection options, refer to Chapter 2.)



The strategy we are recommending is to use small-to-medium-business-grade (SMB-grade) links to complement a corporate-grade link with full service-level agreement (SLA) support. The SLA-grade link provides the foundational network connection; the SMB-grade link adds bandwidth and provides backup at a low cost. Combining the two reduces the overall total cost of operation.

Don't neglect the possibility of incorporating wireless solutions into your network design. Today, 3G and 4G business connections can be configured easily and are reasonably cost-effective. Figure 3-1 shows a typical link balancer installation that uses a combination of wired and wireless Internet connections. (Refer to Chapter 2 for more price and performance comparisons.)

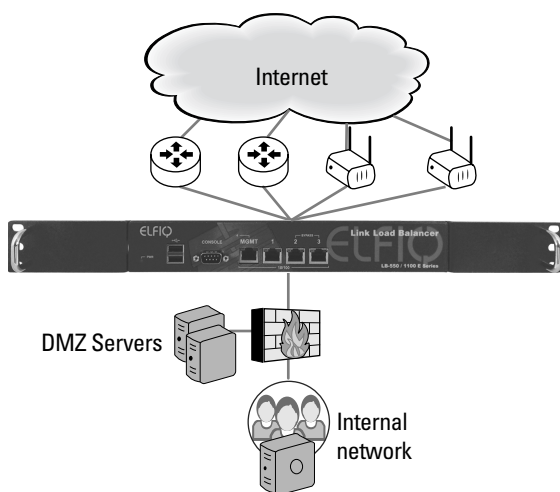


Figure 3-1: Typical link balancer configuration with wired and wireless ISP connections.

Another advantage of using SMB-grade technologies as alternatives to improve bandwidth and network resiliency is the ease with which you can provision and test them. You can install one or more alternate connections, configure them in your link balancer, and use them long enough to determine efficiency and cost. Then either make a long-term commitment or cancel the service if it is not satisfactory.

Balancing inbound connections

Organizations with remote sites and mobile users will want to consider actively managing inbound as well as outbound Internet connections. Requests from outside your organization to servers, *virtual private networks* (VPNs) — private data networks that make use of the public telecommunication infrastructure, usually the Internet, to provide remote users with secure access to their organizations' networks — or other services need quick and efficient routing. Facilities such as Elfiq's Intelligent Domain Name Server (iDNS) (see www.elfiq.com) can do this for you as part of a link-balancing solution. The iDNS will balance inbound traffic based on customer-defined policies and the status of ISPs for uptime and saturation. When an outage occurs on one ISP, the other (or others) can be used and services will still be available. This capability can be very useful for any organization.

Considering traffic segmentation and traffic policies

One way to achieve a smarter network is through active traffic management. After you have established multiple routes to the Internet, you can decide which of these to use for different kinds of traffic. This is bandwidth management at the IP level, so, for example, you can send Web traffic through a DSL modem and put more business-critical traffic on a fiber link. You end up using each ISP for its strengths and cost structure.

Such Quality of Service (QoS) management ensures minimum bandwidth for specific types of traffic, or limits bandwidth by traffic type or carrier. With proper router and link balancer settings you can establish rules to make sure priority traffic has all the bandwidth it needs. Link balancers such as those from Elfiq can establish QoS rules for one ISP or multiple ISPs.

You may also need to manage traffic by time of day. You can maximize bandwidth for VPN connections during the busiest time of day, for example, and allocate Internet bandwidth as needed during off-hours.

Shaping application layer traffic (deep packet inspection)

No matter how much bandwidth you have, users can find a way to suck it all up (and they're good at it). Increasingly popular Internet phone services (such as Skype), live video feeds, file-sharing applications (such as BitTorrent), and other bandwidth hogs can slow critical business applications to a crawl. You can shut down some of these completely if you need to, or you can manage application layer traffic (layer 7 of the OSI model, for you geeks out there). If an application such as Skype is useful to your business, you can allow it to have protected bandwidth allocation while throttling BitTorrent. You can get really detailed with your allocations to maximize what you have in place.

Multiplexing VPNs and VoIP

Organizations that maintain multiple locations often use site-to-site VPNs and VoIP for intracorporate communications. If you're using the Internet to transport this traffic, you can benefit from *multiplexing technology* — where multiple analog message signals or digital data streams are combined into one signal over a shared medium.

Link balancer hardware coupled with multiplexing options can create seamless VPN and VoIP connections via multiple ISPs (and even multiple technologies) to ensure maximum uptime, bandwidth, and link quality. This bandwidth virtualization gathers multiple paths into one virtual path for increased throughput. When a path fails, all the other ones are used but the VPN or VoIP sessions aren't reset, so users aren't affected by outages. This is most efficient for productivity and cost control.

Understanding WAN accelerators

One of the older methods to enhance WAN performance is WAN acceleration. Many implementations exist, but *WAN acceleration* is basically a collection of techniques for increasing data-transfer efficiencies through data compression,

caching, and managing *quality of service* (QoS) (the ability to provide different access or bandwidth priority to different classes of data).

WAN acceleration is just one part of a bandwidth enhancement solution. A link balancer can function well with WAN acceleration technology to give you the bandwidth advantages of both by adding the connectivity redundancy and speed enhancement offered by the link balancer.

Geobalancing the network

After you have established a link-balancing solution, you can choose from many optional and useful features to add. Geobalancing is one of them.

Assume you have more than one data center. If you mirror your server environment at each location, when one site's connectivity slows down or goes away a *geobalancer* can switch automatically to the secondary site. Internal and external users can access online resources, such as online transactional systems, even if a site goes dark.

In addition, geobalancing includes sharing information among disparate sites, including link throughput and saturation statistics, counters, DNS resources, and other information to facilitate mirroring and ISP load balancing.

Geobalancing works both ways. By maintaining a secure, private link among various sites and establishing redundant ISP links at each site, you have established a virtually bulletproof Internet link that can provide seamless connectivity to multiple sites as long as at least one site stays online.

Understanding and complementing MPLS networks

Multiprotocol Label Switching (MPLS) technology lets you interconnect multiple sites over a private network as if they're on the same internal network.

ISPs commonly use MPLS to interconnect sites for an enterprise and to manage service levels. Most large companies

today use MPLS at some point in their networks as a VPN alternative. But if it's your only link, the chance of losing connectivity at some point is very real.

An excellent compliment to MPLS is a link balancer that can tie together multiple sites with multiple MPLS networks across different carriers. This way, if one link is interrupted the balancer avoids that carrier and keeps things moving over the remaining carrier connections.

Migrating from MPLS

In some ways, MPLS has come full circle. Because of price and performance improvements in public networks, many organizations are moving away from private MPLS in favor of public VPN links. But you still need carrier and link management to ensure full uptime.

Features such as Elfiq's SitePathMTPX and a link balancer can multiplex the VPN connection over multiple links, but the connections at each end of the path will appear to be a single path. Again, if one carrier link fails, the remaining links will pick up the slack so that traffic is uninterrupted and users lose nothing.

Making Cloud Computing Soar

Wherever you turn today, the magic word seems to be *cloud* — in computing terms, it's the vast collection of resources and applications available online from just about any Internet-connected device. Computing in the cloud really started to take off in recent years; today, it's rapidly becoming a viable, long-term business networking paradigm. The concept of centralizing application delivery and data storage coupled with syncing services to desktop computers, laptops, and mobile devices is a compelling business proposition.

The cloud concept implies that information, applications, services, and equipment reside off-site. Now network connectivity becomes the critical point of failure. Cloud computing can be efficient and cost-effective, but any number of things can cause a network interruption, which results in downtime, loss of productivity, and expense. (To review the main reasons

why your system may fail, refer to “Designing for failover,” earlier in this chapter.)

Looking at failover in the cloud

You may have planned carefully for site-to-site redundancy, but the move to cloud computing may leave you with a single point of Internet failure. Standard failover design procedures apply to cloud computing scenarios: redundant power supplies, uninterruptible power supplies, multiple ISPs, multiple technologies, and link-balancing hardware and software to tie it all together.

Note that much of cloud computing includes application delivery — a download operation. Therefore, you can consider asymmetrical carrier links such as ADSL or cable modem to supplement symmetrical connections.

Also, implement QoS configurations that allocate symmetrical and SLA-supported links to business-critical tasks, leaving ADSL, cable, or 3G or 4G connections for cloud-hosted applications.



Although 3G or 4G connections can provide useful backup, you'll want to use these alternatives as your last line of defense behind other choices in your network plan.

Planning connectivity for cloud computing

Cloud computing isn't relegated solely to Internet hosting. The cloud concept can work as a privately hosted service as well as an internal service. Successful cloud implementation depends on having a good bandwidth and resilient connections.

As with all of your critical network connections, cloud computing needs adequate bandwidth that's always available. Again, the best insurance against failure is a connectivity design that includes multiple carrier links and multiple technologies. Figure 3-2 demonstrates how you can use multiple ISP connections with a link balancer to provide resilient cloud links.

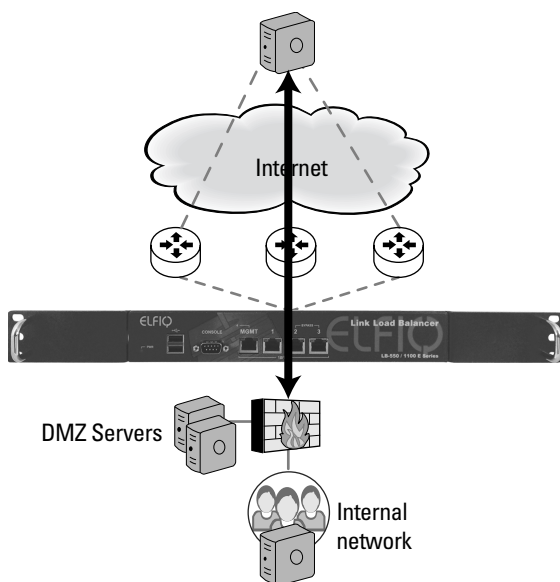


Figure 3-2: Multi-ISP cloud connections with link balancing.

When you're using VPN connections to reach a hosted cloud service, you need link balancing that can restart the VPN session if the designated carrier link fails. Link balancers can manage QoS so the ISP link with the VPN session has the appropriate bandwidth while other traffic is directed to alternate carrier links.



Consider cloud applications such as those by Salesforce.com (www.salesforce.com) or Microsoft Office 365 (www.office365.com). If your employees can't connect to these services, they simply can't work. Costs pile up and delays are unavoidable; therefore, to fulfill the promise of the cloud you need to reinforce your connectivity.

Chapter 4

Introducing Elfiq Networks

In This Chapter

- ▶ Planning for your networking needs
- ▶ Comparing link balancers and routers
- ▶ Looking at Elfiq link balancers
- ▶ Discovering other link balancer features

Throughout this book, we explain why a viable business Internet service requires the following:

- ✓ A firm understanding of user needs
- ✓ Redundant Internet connections that use multiple access technologies
- ✓ A plan for failure and a design for failover
- ✓ Regular reevaluations of the design

In this chapter, we look at some solutions from Elfiq Networks (www.elfiq.com) that will help you accomplish these goals.

Designing Your Network with Link Balancing

Any network design or improvement project requires some research and planning. Seek information from a range of stakeholders within your enterprise. After you have implemented a carefully designed solution, test it and reevaluate it regularly to stay ahead of your users' changing needs and advances in technology.

Understanding bandwidth needs

This piece of advice may sound obvious to you, but it isn't always so: Part of successful network design is having a thorough understanding of why your users need an Internet connection in the first place.

Start your planning by analyzing your current Internet and bandwidth usage. You can get anecdotal information straight from users. Ask them about their perceptions of network speeds and reliability. Then study router logs or install network analyzers so that you really understand how your network and your Internet access functions hour by hour and day by day.



The Elfiq Link LB series of link balancers has a built-in probe that's very useful for analyzing networks.

After doing this bandwidth analysis, you'll understand intimately your users' side of your network usage:

- ✓ Number of users, on average
- ✓ Maximum number of users during the busiest access times
- ✓ Amount and nature of local applications in use
- ✓ Amount and nature of remote (cloud-based) applications in use (such as Web mail, for example)
- ✓ Need for inbound services, such as user virtual private networks (VPNs), e-mail, or Web sites
- ✓ Uptime and bandwidth needs for remote data storage requirements and data types
- ✓ Customer-facing applications and how they're being used to help understand critical customer issues — low bandwidth can drive away customers.

This user analysis will help you understand why your network is performing as it is and lead you toward predicting both short- and long-term needs.

You'll probably assign someone from your IT group to head a team to gather this data. Make sure the resulting information is documented fully in a form the average person can understand. Then share this document with department heads or

group managers. Let them help you interpret this data and offer additional information and recommendations.

This step is particularly important in a dynamic, growing company. Bandwidth needs that IT and top management staff haven't anticipated may be on the horizon. Combine management's recommendations with your usage analysis to guide your planning for Internet service provider (ISP) and technology redundancy.

Finding an ISP provider

After estimating your bandwidth needs, compile a list of available ISP providers and technologies available in your area. (Refer to Chapter 2 for a detailed breakdown of the different technologies that may be available.) Make personal contact with each company so you can understand fully how much bandwidth they can provide, what it costs, and how it is delivered.



The bandwidth delivery method is an important part of your network design. You can use a link balancer to ensure continuous Internet access across multiple carriers, but only if you have different access points for at least two of your bandwidth suppliers. If two carriers use the same fiber or copper, or even the same ditch with a different conduit, all of your bandwidth can disappear quickly in the event of a simple construction mishap.

Create your list of service providers in a way that will help you compare and interpret the information you gather. You'll want to find the best cost-versus-performance combination that also provides the best link redundancy. Don't hesitate to ask potential carriers tough questions about their uptime and support policies — not just system-wide, but in your actual location. Ask for references from customers who have bandwidth needs similar to yours. Talk to them. Share needs and glean experience from them in dealing with prospective carriers.

Avoiding points of failure

As you finalize your design, make sure you understand and have accounted for typical points of network failure. Table 4-1 summarizes these failure points and offers solutions.

Table 4-1 Typical Network Failure Points

<i>Point of Failure</i>	<i>Description</i>	<i>Resolution</i>
No ISP diversification	Single sourcing of multiple links creates a single point of failure.	Choose multiple ISPs and multiple carriers.
No technology diversification	Different ISPs may share the same carrier and physical delivery paths, creating a single point of failure.	Use different central office (CO) connections with different ISPs. Also use different technologies.
Construction mistake	Repair or expansion activities around delivery media can damage cabling.	Design for at least two delivery paths to different sides of your facility. Include wireless delivery in your design.
Equipment failure	Routers, modems, servers and link balancers can fail, causing network interruption.	Use redundant equipment at key locations.
Human error	Sometimes ISPs make mistakes in configuring their equipment, which results in downtime.	Use multiple carriers.



In a nutshell, to prevent network link failure, use multiple physical links and backup equipment.

Deploying link balancing

If you design and implement multiple carriers and multiple technologies without also using link-balancing technology, you'll have to manually manage bandwidth allocation and uptime. A *link balancer* works with your routers, modems, and other Internet interface equipment to

- ✓ Allocate bandwidth from various ISPs
- ✓ Combine bandwidth to provide seamless speed enhancements for outgoing and incoming sessions
- ✓ Monitor each link, and switch providers if a link fails
- ✓ Manage bandwidth and quality of service

The information you discover during your bandwidth and user needs analysis will help you configure your link balancer for best efficiency in your particular network.

Testing and measuring results

Testing is the part of network design that's easy to forget or ignore. Network design is not a static endeavor. As soon as you have everything working according to the guidelines we discuss here, start your testing again.

First test bandwidth and uptime. Then test your failover design. We know of numerous companies that implemented redundant network design or data backup strategies and didn't test them until a failure occurred. Surprise! Failover failed and the backup media couldn't be restored, or the intended backup ISP link didn't come online as expected.

Use online resources or LAN- and WAN-based software to analyze your bandwidth delivery to each section of your network. Conduct these tests at various time to ensure that you have the bandwidth you expect at all times.

Judging uptime also requires some effort and additional software, but you need to know not only that you achieve a given bandwidth goal over time, but that your connections also are live all of the time. You can use freeware such as Cacti or MRTG (Multirouter Traffic Grabber) to analyze network statistics. Commercial alternatives include HP Open View or SolarWinds.

Schedule a time when network requirements are minimal, notify users that you're conducting a test, then pull the plug on the primary equipment and your main ISP carrier. What happened to bandwidth? Did your design maintain an Internet connection? Were users aware that something had changed?

Then what happened when the primary equipment or ISP carrier were restored? The restart should be seamless.

Periodically reevaluate your bandwidth so you can stay current with technology and ahead of your users' needs.

Understanding Link Balancing: How It Works

What is a link balancer? How does it work?

You don't have to understand every detail of link-balancing technology to implement a successful network design. But having a feel, at least, for the underlying technology is helpful.

At its core, a link balancer is an intelligent network address translation (NAT) multigateway router and bridge — a with a difference. A traditional router gathers traffic from your local area network (LAN) and internal servers and sends it to an ISP and other wide area network (WAN) locations (refer to Chapter 3). A router may support multiple ISPs, but generally the second connection is a fail-safe backup that remains idle unless the primary link fails.

A link balancer can't operate in your network without a gateway device such as a firewall and edge routers, but it can provide simultaneous connections to multiple Internet suppliers. This lets you combine ISPs for more bandwidth while providing fail-safe backup for a downed link.

Another difference: A router manages outbound traffic only, whereas a link balancer can manage inbound traffic as well. This means if your company is using user VPN connections, for example, the link balancer can ensure maximum bandwidth for this inbound traffic and can switch ISP links if necessary to correct for a broken connection.

Complementary link-balancing services include quality of service (QoS) for traffic allocation, site-to-site resiliency and link bonding, geographic load balancing, the possibility to enable or disable balancing rules depending on specific conditions or status, and the verification of available traffic destinations.

As shown in Figure 4-1, a link balancer usually installs outside your LAN firewall and before the modems and routers that connect to the WAN.

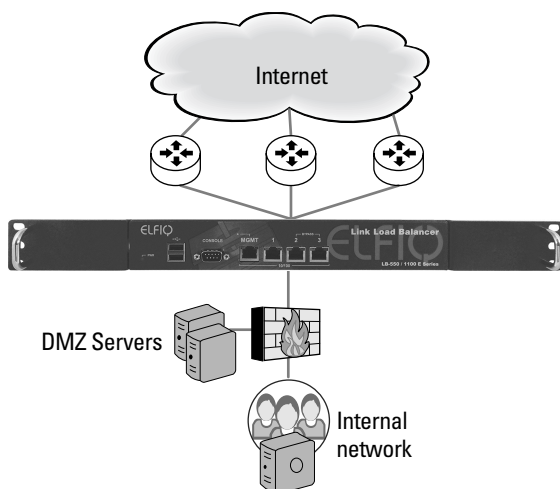


Figure 4-1: Typical link balancer installation.

If you're managing connections among multiple corporate locations where you need to balance private networks and WAN/MPLS networks, the link balancer may be installed behind the firewall, as shown in Figure 4-2.

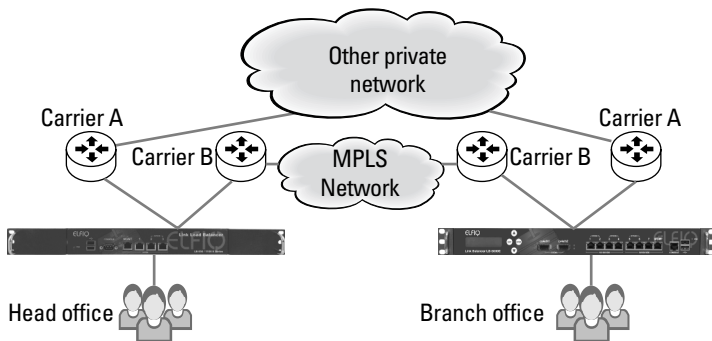


Figure 4-2: Link balancer installed behind the firewall.

In addition to routers and modems, your network may include other devices, such as Web filters, traffic shaping appliances, local or server balancers, and WAN accelerators. Link balancers function well with these network appliances.

Reviewing Elfiq Link Balancers

Elfiq Networks offers link balancers for small and medium businesses, as well as enterprise-level applications. These are space-efficient, power-optimized, rack-mounted devices with similar appearance across the product line.

For basic operations, you may need only two or three ISPs to provide adequate bandwidth and resiliency. The Elfiq LB-550 series, shown in Figure 4-3, will do it at an attractive starting price with expansion capabilities.



Figure 4-3: Elfiq LB-550 link balancer.

The medium-sized-business products include the LB-800 (6 ISPs), LB-1600 (16 ISPs), and LB-2500 units. The 2500 series supports 64 ISPs, includes two virtual link balancers within one unit, supports gigabit port speeds, and is cloud traffic balancing and data center ready.

The LB-5000 unit, shown in Figure 4-4, supports enterprise-level installations with as many as five million concurrent sessions. It includes 10 Gbps ports and is global data center ready. It supports five virtual link balancers inside a single appliance. A device at this level can serve well within a world-class data center.



Figure 4-4: Elfiq LB-5000 link balancer.

Any of the Elfiq units can support traditional carrier links, such as T1s and fiber, or small-to-medium-business-grade (SMB-grade) ISP connections, such as DSL and cable.

Implementing Link-Balancing Solutions

Beyond the basic concepts of bandwidth augmentation and link failure recovery, you'll want to consider a few other concepts as you design and implement your link-balancing solution.

Link balancer inline operation

Elfiq link balancers are designed to be transparent (or inline) on an organization's network, so you don't need to redesign or reconfigure your routers, firewall, or other network devices. The WAN ports used by the Elfiq don't have IP addresses, so they can't be attacked in the usual ways. This brings an extra layer of security to the Internet zone of your network.

Link balancer hardware uptime

Throughout this book, we mention the importance of failover planning as part of your Internet access optimization planning. Having a link balancer helps prevent Internet outage if an Internet link goes down. But what about the link balancer itself?

If all of your traffic flows through a link balancer and the link balancer malfunctions or loses power, chances are all of your Internet connections will go offline. Among the advantages of the Elfiq design is its automatic LAN fail-safe feature. If the link balancer fails, traffic is passed automatically to original perimeter devices as if the Elfiq unit weren't even there until the fault is repaired.

High-availability pairs

To provide reliable uptime for all your network components — servers, routers, modems, or link balancers — you need backup hardware. Preferably such backups can switch automatically from a primary unit to a backup unit in the event of a failure.

Many of Elfiq's link balancers can operate as high-availability pairs. In this configuration, one unit operates as a master device and a second unit functions as a passive, or slave, unit. Both units communicate information and metrics constantly; if the primary unit fails, the secondary unit assumes traffic management duties and sends an alert to the IT department about the failed unit.

Inbound balancing

Internet traffic runs both ways, so if you're in the balancing game, you should play both sides. You can configure Elfiq link balancers to balance inbound traffic as well as outbound traffic. This capability is particularly important if your organization is operating VPNs for remote users and using on-premise customer-facing Web applications.

Inbound balancing works by managing Domain Name Server (DNS) requests to in-house resources. The link balancer stores some of the same information as your DNS and can route requests ahead of the DNS itself.

Traffic segmentation

In addition to automatic load balancing and failover operation, you need the ability to actively control the traffic that uses each carrier link. You may want to relegate critical business traffic to a primary ISP that offers a firm service-level agreement, for example, while forcing general Internet onto one or more asymmetrical links such as DSL.

Your link-balancing solution should support multiple traffic rules to manage this kind of allocation. Traffic management rules help you ensure the proper bandwidth for different classes of traffic.

Quality of service (QoS)

QoS management is a step above fixed-traffic management. To truly manage QoS, you need to be able to dynamically ascertain traffic type and assign appropriate bandwidth to it, and also choose which carrier link you want to use at any given moment to achieve this level of service.

For example, your link balancer may be handling the download of a large file with no other traffic demanding much attention. In this situation, virtually all of the available bandwidth may be allocated to this download.

However, if a voice over Internet Protocol (VoIP) conference call is launched, requiring bandwidth for several users, the system should be able to reduce bandwidth for the file download and ensure enough bandwidth for quality voice communication.

Support diverse technologies

With a well-designed link-balancing strategy, you aren't relegated to traditional business Internet links. The Elfiq link balancer lines can support expensive corporate T1, fiber, and DS3 links, of course, but they also work with 3G/4G wireless or other SMB-grade links. You can use Ethernet or a USB-based wireless 3G/4G modem directly in the link balancer appliance to connect to a wireless network.

Multiple dynamic configurations

The Elfiq Intelligent Condition Vericator (ICV) is an example of multiple configuration support. Such a facility handles various preprogrammed "What if?" scenarios. For example, you can instruct the link balancer to take specific actions when a link fails or becomes saturated. You can use this facility to modify traffic handling by time of day, to reduce costs through intelligent carrier selection for different kinds of traffic, or to reset statistics and counters at a set date or time.

Application traffic management

Particularly with the advent of cloud application delivery, the ability to manage traffic based on application type is becoming increasingly important. Users quickly become dissatisfied when application slowdowns occur, which will reduce the efficacy of network-based application delivery.

Site-to-site multiplexing

If you're supporting multiple corporate locations, you're probably using VPN and VoIP connections among them. Elfiq's SitePathMPTX application enables site-to-site link multiplexing. This means you can use multiple carriers at each site to connect your site-to-site VPN but operate these connections as if they're a single-site path link. This is transparent to your firewalls, establishing the site-to-site VPNs with remote locations. Other link-balancing features — such as fast-link selection or shutting down a malfunctioning link — are maintained during multiplexing. Sessions aren't reset, which becomes a huge productivity gain. Think of the costs of your company getting disconnected for two or more hours from the main data center, where all the computing activity happens in a centralized environment. (Refer to Chapter 3 for more on multiplexing.)

Multiple data center support

If you're supporting two or more data centers, you need the ability to mirror these sites and also to maintain accurate data storage and delivery in the event of a link or a site failure. Elfiq's Global Geolink feature can support as many as six separate sites and maintain resilient communications as long as at least one site is operational.

This geobalancing switchover can occur within a few seconds of a link failure. (Refer to Chapter 3 for more on geobalancing.) In addition, a secure private link is maintained among sites for the exchange of link-balancer metrics such as link status and availability.

Chapter 5

The Part of Tens

In This Chapter

- ▶ Evaluating business connectivity
 - ▶ Managing bandwidth and uptime
 - ▶ Breaking down your goal into manageable steps
 - ▶ Working your plan
-

Technology can be a boon or a bane. We depend on it for business success. Technology alone can't keep our networks running and efficient, however. And if we forget to manage critical business tools, things can get out of control in a hurry.

The business of this chapter is to iterate some of the keys to successful Internet management — steps to help you stay focused on the all-important goal of maximizing reliable connectivity and bandwidth.

Evaluate Your Business Connectivity

Part of network and Internet connectivity design should be a thorough evaluation of current and future needs. When you've implemented a design, don't assume it's the final version.

Regular reevaluation of bandwidth needs, uptime, and usage patterns will help you ensure a better, more reliable Internet experience across the enterprise.

Understand Lost Connection Consequences

When your single Internet connection goes down, it's pretty obvious. Nothing works. But if you're maintaining multiple paths to the Internet as we advise throughout this book, a lost connection is harder to detect — and even more so if the broken link happens during a time of reduced activity or repairs itself fairly quickly.

Make no mistake: Such Internet interruptions will affect your business, especially if you haven't designed for seamless link balancing that can maintain an application connection, a VPN link, or a VoIP call through a lost Internet connection.

Consider Alternate Technologies

For many years, dedicated high-speed lines were the default choice for business-critical Internet connections. Today, multimedia requirements, nearly constant mobile device access, graphical interfaces, and greater dependence in general on the Internet have all but made the traditional 1.5 Mbps T1 line woefully inadequate.

You can use multiple T1s, of course, and you can purchase DS3 access (45 Mbps). But to ensure continuous bandwidth, consider using multiple technologies. Telco-provided DSL or cable modem access offer reasonably priced high-speed connections. These connections may be considered small-to-medium-business-grade, but they can be incorporated into your link-balancing scheme. And, if they're used in conjunction with traditional links, they form part of a redundant, reliable design. (Refer to Chapter 2 for a rundown of all your connection choices.)

Implement Redundant Connectivity

You back up your data. You also should back up your Internet connection. This means simply using multiple connections. But more than that, using multiple service providers and, where practical, multiple physical routes of access are a good idea.

For dedicated line access, for example, choose T1, fiber, or DS3 lines from more than one carrier and understand what route they use to connect to your offices. In some areas, multiple carriers share last-mile access. If this is true where you are, try to figure in redundant paths to at least one of those providers. Wireless hops across the shared access lines can work, or investigate installing your own last-mile link to a second ISP.

Maximize Network Bandwidth

This one's easy: Faster is better. Right? Part of achieving faster Internet connection is redundancy and multiple technologies. But you can't just hook up a lot of Internet connections and let the thing run.

Integrate automated and manual network analysis into your design. If even one router is bogging down, or one ISP connection is lagging, your bandwidth is suffering.

Achieve a Balanced Network Design

Balance: It's a good guiding principal for life. It also is a good principal for successful network design. That means incorporating all the major concepts we present in this book: Use alternate connection technologies, implement redundant connectivity, establish access via multiple vendors, and incorporate automated link-balancing technology.

Choose Link-Balancing Technology Carefully

So, you agreed with us that link balancing is a good thing for your network. Take the next step and make sure you choose the correct technology for your needs — and technology that's reliable and cost-effective. You may need to actually install and test products, and certainly you need to establish a close relationship with the technical folk from any supplier you're seriously considering.

Use Cloud Computing as Appropriate

Remote applications, online data storage, mobile access, and other potential benefits come with computing in the cloud.



Cloud computing is computing as a service instead of as a product. Shared resources, applications, and data are offered like a utility over a network.

Although we tend to equate the cloud with the Internet, that's only part of the story. Corporate servers on private networks can support a cloud environment by hosting applications and data storage. A computer cloud reduces application and data repetition, can lower costs, and facilitates updates and user management.

If you're not already using some aspects of the cloud within your enterprise — at least on a trial basis — you're falling behind. Cloud computing isn't for everything you do, but it may fill some important gaps in application delivery or backup storage.

Understand Wireless Issues

Wireless connectivity is more than just another network connection. It's a critical part of business connectivity, but it also brings with it a set of unique challenges. The explosion

of worker-supplied mobile devices presents opportunities for business efficiency, lower costs, and employee satisfaction. It also means you need to completely understand the associated bandwidth, security, and connectivity issues.

If you aren't actively managing your current mobile environment — and planning aggressively for the technical and social metamorphosis already underway — you're heading for some unpleasant surprises.

Look to the Future

Internet technology is anything but static. The success of your business and its Internet connectivity depends on understanding what's happening today, actively managing what you've got, and constantly analyzing what's coming.

Stay in contact with current equipment suppliers. Stay on top of new developments. Install the newest technology in a test environment, and work it into the mainstream as it matures.

The reward for constant technology vigilance is an efficient network . . . that works!

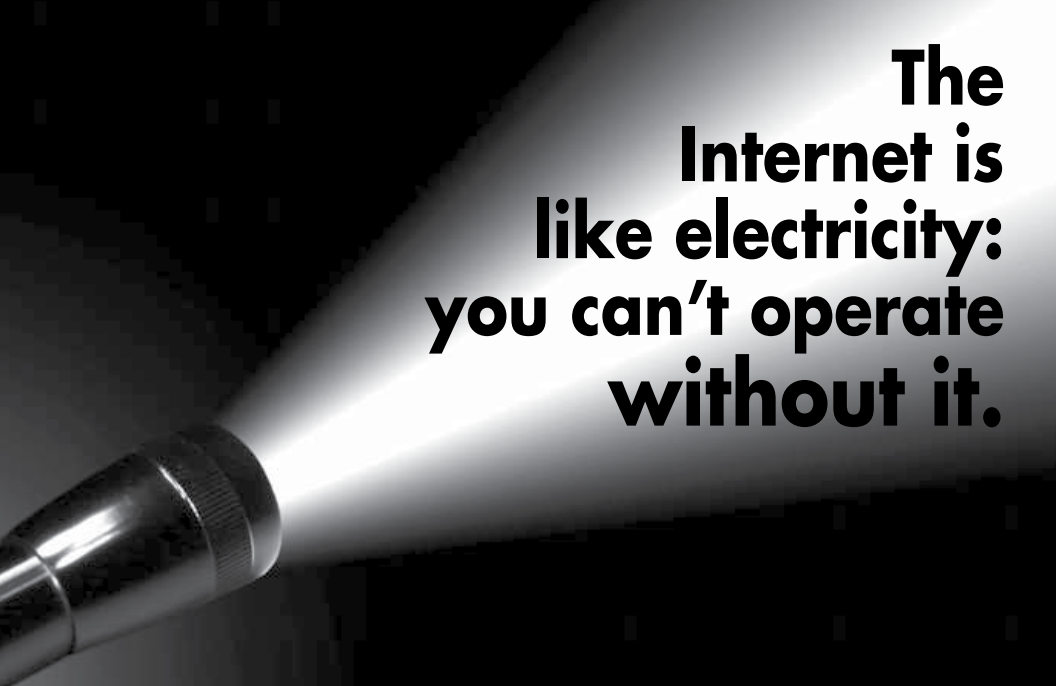


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