

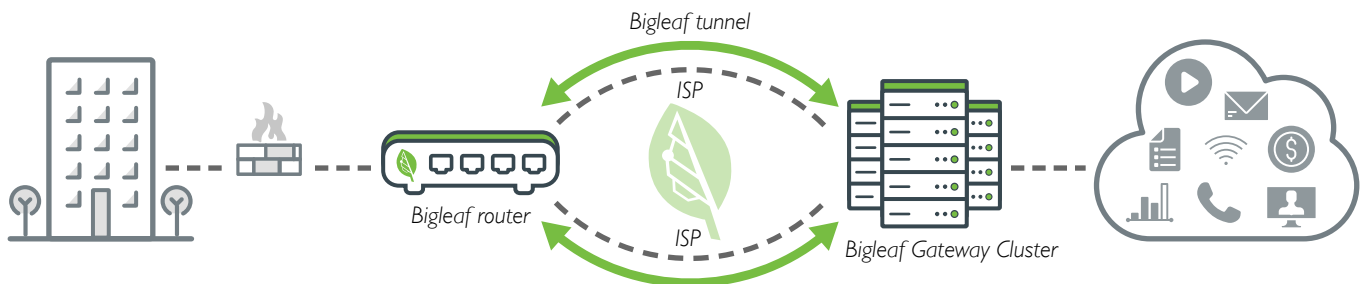
Technology

We believe that access to the cloud requires a new generation of Internet connectivity. You shouldn't have to worry about Internet connections, performance, or outages.

Our unique network architecture and SD-WAN technology optimizes application performance across each ISP connection, and also can leverage the strength of multiple ISPs, all with the simplicity of a single plug-and-play connection.



BIGLEAF'S SITE-TO-CLOUD ARCHITECTURE



The Bigleaf router installs outside the firewall, prioritizing application traffic in and out of the customer's LAN



Multiple broadband circuits are tunneled together as one pathway, providing bidirectional control and visibility of all traffic

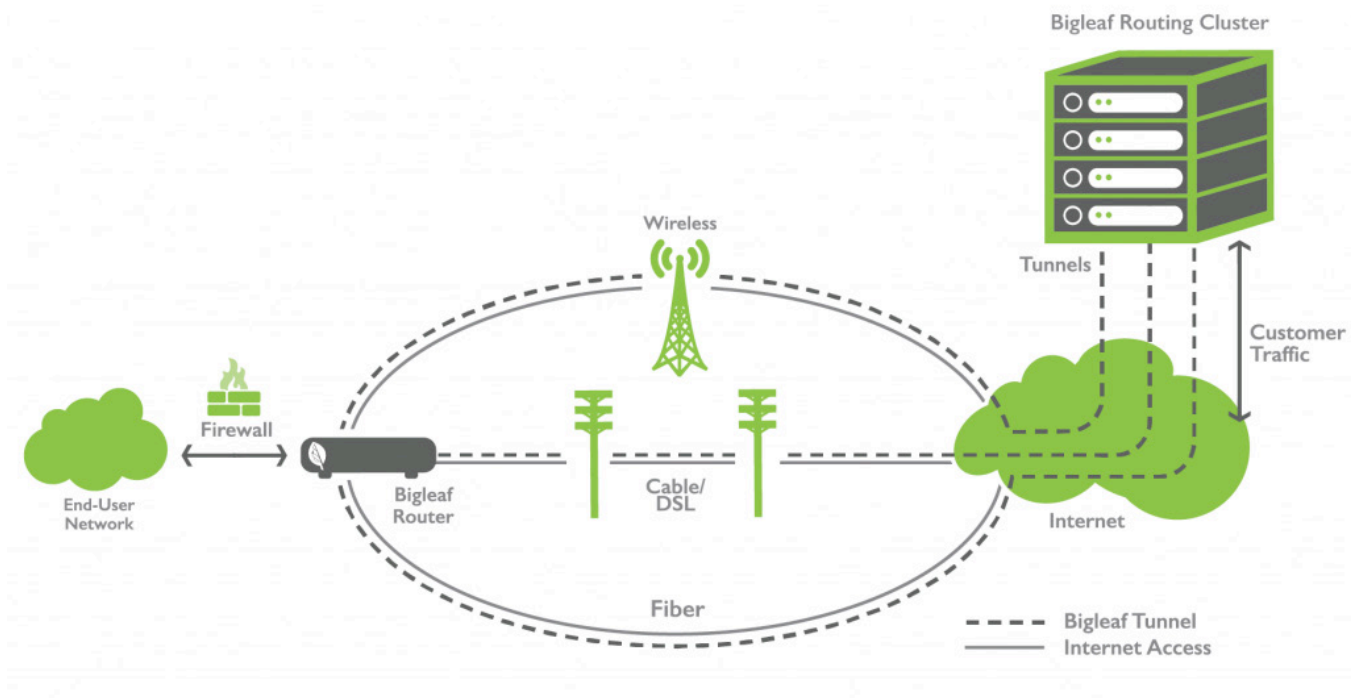


Bigleaf's Gateway Cluster connects this streamlined Enterprise-grade connection to any Cloud application

Architecture

Natural Networking

Bigleaf uses the natural architecture and intelligence found in leaves – their veins provide redundancy to all areas of the leaf, and the distribution of nutrients is load balanced. We apply those same organic principles to your Internet connections. We use Software Defined Networking (SDN) technology to tunnel your traffic over the leaf “veins” (your multiple Internet connections), between our gateway clusters and our on-site router in your building. From there we provide you a single optimized and redundant handoff.



If, for example, one of your Internet connections gets cut by a backhoe, your traffic is automatically routed over the other redundant path(s). When each of your Internet connections are healthy we intelligently aggregate your traffic across all of the connections to provide you with the highest possible throughput. Our proprietary algorithms feed on detailed monitoring data from our custom Network Monitoring Systems, allowing routing changes to take place seamlessly within 4 seconds of changing circuit or traffic conditions.

Redundancy

For truly reliable Internet connectivity you need redundancy. We provide redundancy in a way that's easy to set up and gives you peace of mind. Our gateway cluster infrastructure has hot-standby N+1 architecture implemented at all levels for maximum uptime, and having 2 or more last-mile Internet connections gives you diversity all the way to your building. We also offer a high-availability on-site router option if you need the ultimate in redundancy.

Our Internal Architecture

We use these methods to ensure that our systems won't reduce your uptime, but instead improve it:

- Dedicated Bigleaf-owned server and network infrastructure (no shared resources)
- Active-active redundant routers and switches in our core network
- N+1 provisioning of server capacity and hardware in our core network
- Multiple diverse upstream Internet connections at each core site
- Geographic redundancy between multiple Bigleaf core datacenter sites, so your service isn't dependent on any one datacenter or geographic area

On-Site Equipment

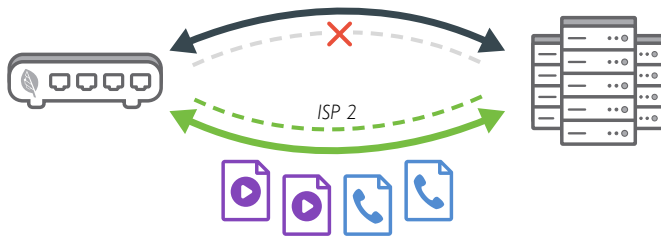
If you have high-availability (also known as "hot standby") firewalls and/or routers then it's understandable that you would want to keep that level of equipment redundancy when you add Bigleaf service to your Internet connectivity. We provide an option for a High-Availability on-site router setup that includes redundant routers and switches to ensure that no single piece of equipment can cause a failure of your Bigleaf service.

For more details on the various risk factors to consider, and for some guidance regarding if the high-availability router option would be a good fit for your environment, please review our Risk Factors White Paper ([pdf](#)).

Same IP Address Failover

Your IP Addresses, In The Cloud

As far as your network is concerned, Bigleaf becomes your new ISP. Your underlying Internet circuits are abstracted away, so your network doesn't have to concern itself with changing IP addresses.

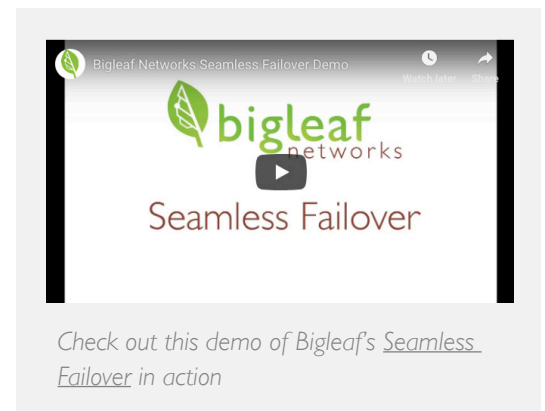


This works because before your traffic traverses the path between our gateway clusters and your building, we encapsulate each packet in a tunnel. This encapsulation enables us to provide you with static IP addresses that don't change when your traffic moves between ISP connections. You can use Bigleaf IP addresses, or if you have your own portable block we can route that for you.

Why does this matter? Because with Bigleaf, when one of your Internet circuits has an outage, you don't. Your IP address doesn't change. Your VPN, remote desktop session, SSH session, VoIP call, Web Presentation, and every other application stays up!

Last-Mile Internet Redundancy

For maximum reliability you should use at least 2 ISP connections. The benefit of this is that you're insulated from many issues. In addition, we recommend that you use physically diverse paths coming in to your building from unique providers, such as: fiber and cable, DSL and fixed-wireless, or T1 and cable, that way you'll have the ultimate in Internet redundancy.



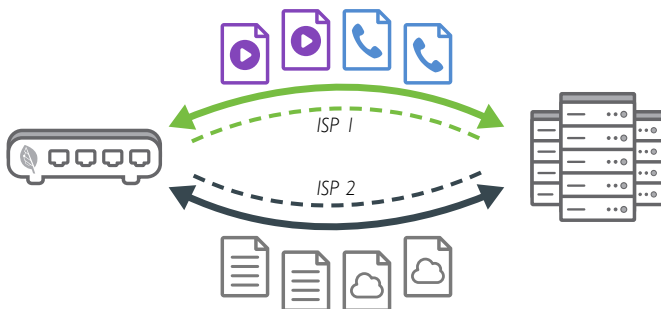
You'll Be Protected From:

- Cable cuts near your building, from construction, car crashes, maintenance gone wrong, or anything else
- Routing issues on any of your Internet circuits
- Scheduled and unscheduled maintenance on any of your Internet circuits
- Peering issues or disputes that could otherwise disconnect you from parts of the Internet
- Network instability one of your provider's networks
- Packet loss due to overloaded circuits

Every trouble-prone part of your Internet path is covered by Bigleaf redundancy, and yet we still provide you with a user-friendly single handoff to plug in to your firewall or router.

Intelligent Load Balancing

The Internet is a dynamic, changing set of interconnected networks with variable performance. We built Bigleaf to adapt dynamically as your Internet connections change. To accomplish that, we've built advanced monitoring and real-time adaptation into the core of the Bigleaf system.



End-to-End Advanced Monitoring

Each Internet circuit that you plug in to your Bigleaf on-site router is measured 10 times per second in both directions. This provides sub-second monitoring of multiple circuit metrics, including:

- Latency
- Jitter
- Packet Loss
- Capacity

Traditional load-balancers or multi-WAN firewalls use one or a few fixed IP addresses or host names to monitor the status of each Internet connection. These methods monitor a tiny subset of Internet paths to determine the entire status of each internet connection. To provide end-to-end visibility, our monitoring system measures each internet connection from your location, all the way through the majority of the internet path, to our gateway clusters.

This provides a complete picture of the performance of each circuit. The remaining portion of the Internet path, from our gateway clusters to the endpoint your traffic is talking to (e.g. Google, your VoIP provider, your remote site), is generally very reliable since we're directly wired in to major Internet backbone peering exchanges.

Since the Bigleaf system has end-to-end monitoring, it adapts to issues wherever they are in the last-mile and middle-mile of the Internet – where issues most often occur. This helps insulate your Internet experience from routine ISP problems like peering disputes, unplanned maintenance, bittorrent traffic, and ISP human error.

We use that performance data to load-balance your traffic in real-time according to circuit conditions and application needs.

Bandwidth Aggregation and Optimization

Redundancy feels wasteful when you can't make use of all the bandwidth you're buying. We solve that through a unique adaptive load balancing system. This aggregation of bandwidth makes the most efficient use possible of all your Internet circuits.

Every “multi-wan router” or “Internet load-balancer” says they optimize your Internet, perform intelligent routing, and give you the best experience possible. So how is Bigleaf different? Beyond the practical difference that our solution is a service rather than a box you buy, we act on 2 fundamental differences. We believe that:

- Each of your Internet circuits likely has different, unique performance characteristics.
- Each application you're using has specific network performance needs.

Our system identifies your application traffic flows in real time. As you use the Internet, we detect what kinds of applications you're using and automatically determine what the performance needs of those applications are. We then use patent-pending algorithms to integrate that application traffic flow data with the real-time circuit monitoring data that our system gathers. This combined dataset is used to ensure optimal load-balancing and QoS for all your applications at any given point in time.

This means:

- Traffic fails over between circuits within 4 seconds in response to the outage of a circuit, so VoIP calls, downloads, uploads, or any other sessions move between circuits seamlessly.
- ISP issues like heavy oversubscription, saturated router interfaces, peering issues, and other causes of variable performance are detected and traffic is re-routed immediately, mid-stream.
- You get the fastest speed possible for your big file transfers, while your real-time traffic like VoIP takes the most reliable path available

The Perfect Match

Bigleaf Intelligent Load Balancing uses Software Defined Networking (SDN) to continually match your application traffic needs with the current Internet connection capabilities.

Flexible Load Balancing Algorithms

Depending on the traffic type, circuit conditions, circuit capacities, and other factors, our system will either:

- Load-balance over all circuits
- Load-balance over a subset of circuits
- Send traffic down one circuit

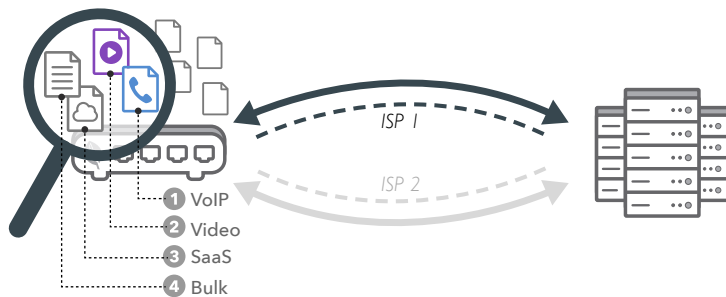
All of these options are available to each type of traffic at any point in time, and decisions are made independently for each direction of traffic (upload/download) to provide you with the best possible performance.

Dynamic QoS

QoS Everywhere

VoIP over cable. Web Conferencing over wireless. Electronic Medical Records over DSL. Do these ideas make you cringe?

As network engineers, they used to make us pretty nervous since QoS over the public Internet wasn't really possible. Bigleaf solves that problem. Since we identify application traffic, and since we're constantly aware of circuit throughput, we can successfully apply QoS policies to any circuit, ensuring that ISPs don't buffer and delay your critical real-time traffic like VoIP. We don't need SLA-backed circuits to provide enterprise-grade QoS.



Enterprise-Grade Service Over Cheap Circuits

Typically if you want 100Mbps of enterprise-grade Internet speed you have to buy a \$500-\$1500 per month fiber connection. On the other hand, you could buy a 100Mbps cable connection for \$199 per month, but it certainly wouldn't provide QoS prioritization of your real-time traffic.

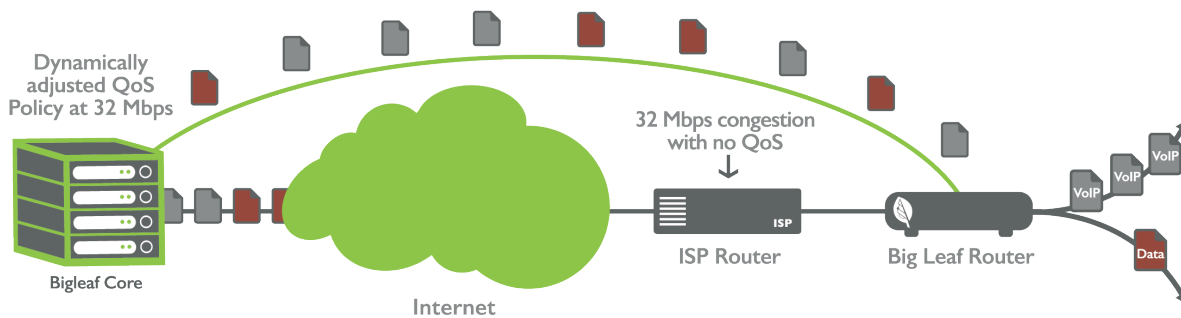
Now with Bigleaf you can get the reliability and performance of the \$1500 per month circuit by using two or three \$50-\$200 per month circuits. In addition to load-balancing based on circuit and application needs, our Dynamic QoS system will ensure that your sensitive VoIP, SSH, Remote Desktop, and other crucial traffic streams aren't degraded by ISP congestion.

Single Circuit Benefits

Our Dynamic QoS even works on a single Internet connection! So while our system won't be able to move your traffic between circuits, you can still enjoy all the QoS prioritization, circuit monitoring, and proactive alerting benefits from Bigleaf, even with just 1 Internet connection.

Automatic Adaptation

The Bigleaf system is continually monitoring each of your Internet connections. Based on changing circuit conditions, QoS settings and rate limits are adjusted in real time to give your traffic the best possible experience. This system is simple to use, you just sign up for Bigleaf service and let our software do the rest! It automatically identifies your traffic types, determines which traffic flows require prioritization (such as VoIP), and applies QoS, all without any manual configuration. If you happen to have some esoteric application that we don't match on by default, we can also set up custom rules to meet your needs.



Better VoIP with Bigleaf

Check out more info on how Dynamic QoS works, specifically improving VoIP quality, [here](#).

About Bigleaf Networks

Bigleaf provides a software-defined WAN solution built with a Cloud Access Network that enables you to ensure performant uptime for any Cloud-based technologies across all sites and users. Unlike policy-based solutions, Bigleaf auto-detects application needs and network conditions and intelligently adapts traffic in real time. With Bigleaf, you can easily provide Enterprise-grade connectivity for all of your Cloud applications, improve visibility into your internet usage, and simplify your network.