



Making Home Internet Work for Business Applications

In the spring of 2020, millions of workers in America were suddenly asked to work from home if possible. Of those who were employed and didn't work from home already, **57.7%** reported that they had recently begun working from home in April 2020.

Almost overnight, the number of remote workers went from **4.7 million** to an estimated 85 million. This is stressing networks, application providers, and IT teams like yours who need to optimize these workers' productivity.

Home internet connections that were once a desert from 8am to 5pm are now flooded with Zoom, Microsoft Teams, Slack, Bluejeans, Office365, email, and VOIP traffic. In truth, the trend was already toward working from home. The number of remote workers grew 44% over the last five years with no sign of slowing.

Pushing Residential ISPs to Their Limits

IT departments asked to support remote workers are challenged by residential ISP networks. The business network

was wholly in their control. Now, the users are connecting from a mix of ISPs through cable, DSL, and fiber – perhaps even satellite and microwave. However home office workers connect, network administrators no longer have visibility into usage patterns, performance issues, and sources of problems.

People working from home suddenly need more than a reliable connection to their network. They need reliability AND performance, as both significantly impact their ability to get work done. Even the "fastest" home network connection available will often leave users with laggy and choppy video conferences. However, there are ways to identify problems and improve the home office experience.

Covered in this e-Book

- The differences between home and business internet connections
- Network causes for application trouble
- Diagnosing and resolving network problems



Typically passing through more distance and equipment, home internet connections are subject to lower reliability than business connections.

How the Internet at Home is Different than Internet at the Office

When workers open up their laptops in their home workspaces, the applications look the same as they do at the office, but those apps are taking a very different route to the internet.

Farther From the Internet: Your Data Has to Do Your Commute

Due to geography, logistics, and economics, residential areas are connected to the internet differently than business areas. To route down residential streets and across neighborhoods, networks require more transitional elements and more cable. It is like each packet has to do the daily commute now.

All the devices between the home office and the ISP's connection to the internet backbone are more points for things to go wrong; more cables to get damaged, more amplifiers, and nodes that get flaky. Whether copper, broadband, or fiber optic, more cable and connections degrade signal in ways that can delay and scramble traffic. For your internet traffic's commute, that translates to more backed up intersections and potholes.

By comparison, ISPs' network points of presence are closer to business districts and hubs. Their business clients use more robust fiber connections and trusted digital protocols like frame relay, MPLS, and metro Ethernet. The ISPs provide service level agreements (SLAs) that reassure businesses of uptime, speed, and quality of service. A business connection doesn't involve as many changes in media, shared resources, and weather-beaten equipment.

Common failure points for residential ISP connections

Residential networks come in many flavors, but they all have points of failure

Broadband cable modem

Temperature changes cause connectors to retract, weakening connections.

DSL

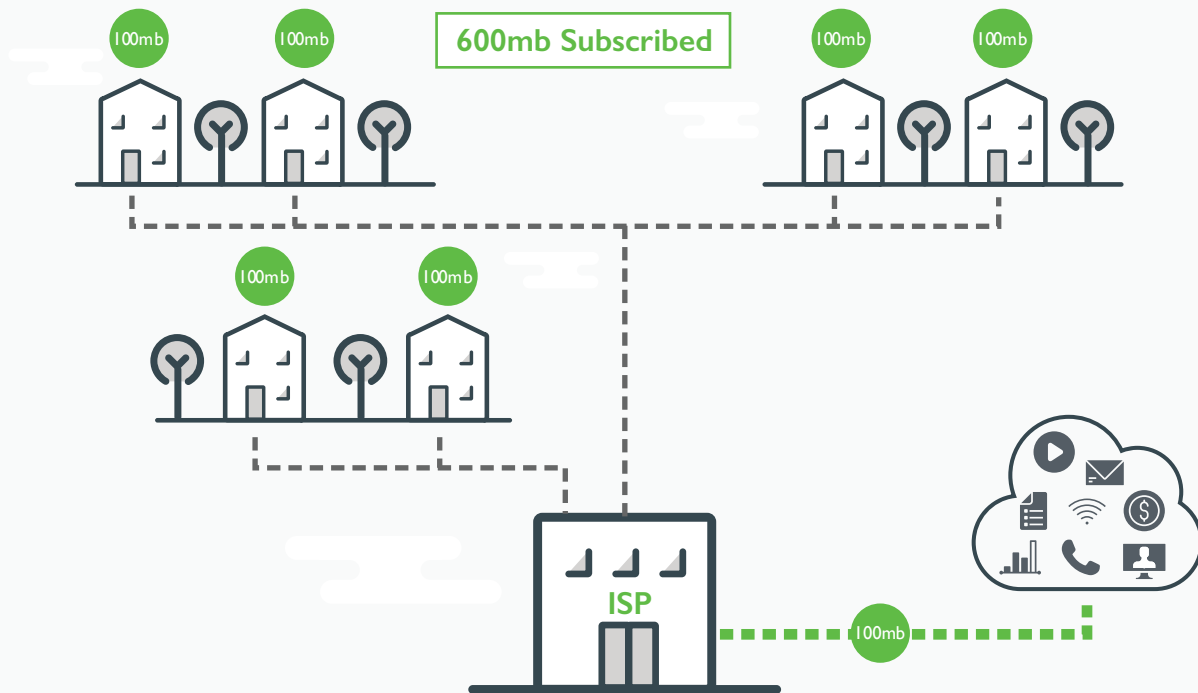
Cross talk between circuits slow and disrupt traffic.

Fiber to the home

Tight bends in the cable and dirty connectors weaken signal, dropping link and packets.

The other key issue is oversubscription...





Oversubscription: Sharing with Your Neighbor Keeps Costs Down

The vast majority of residential users' demand is well below the capacity of their subscribed connections, so ISPs can sell more than their capacity. Of course, when the whole neighborhood starts to work from home, it's a different story.

Like so many internet issues, this can be explained with roads and cars: It would not make any sense to build a freeway to your driveway. We build smaller, residential streets where the demand is not that high. These feed into freeways that have much higher capacity. ISPs provide access to the internet for all their subscribers in much the same way.

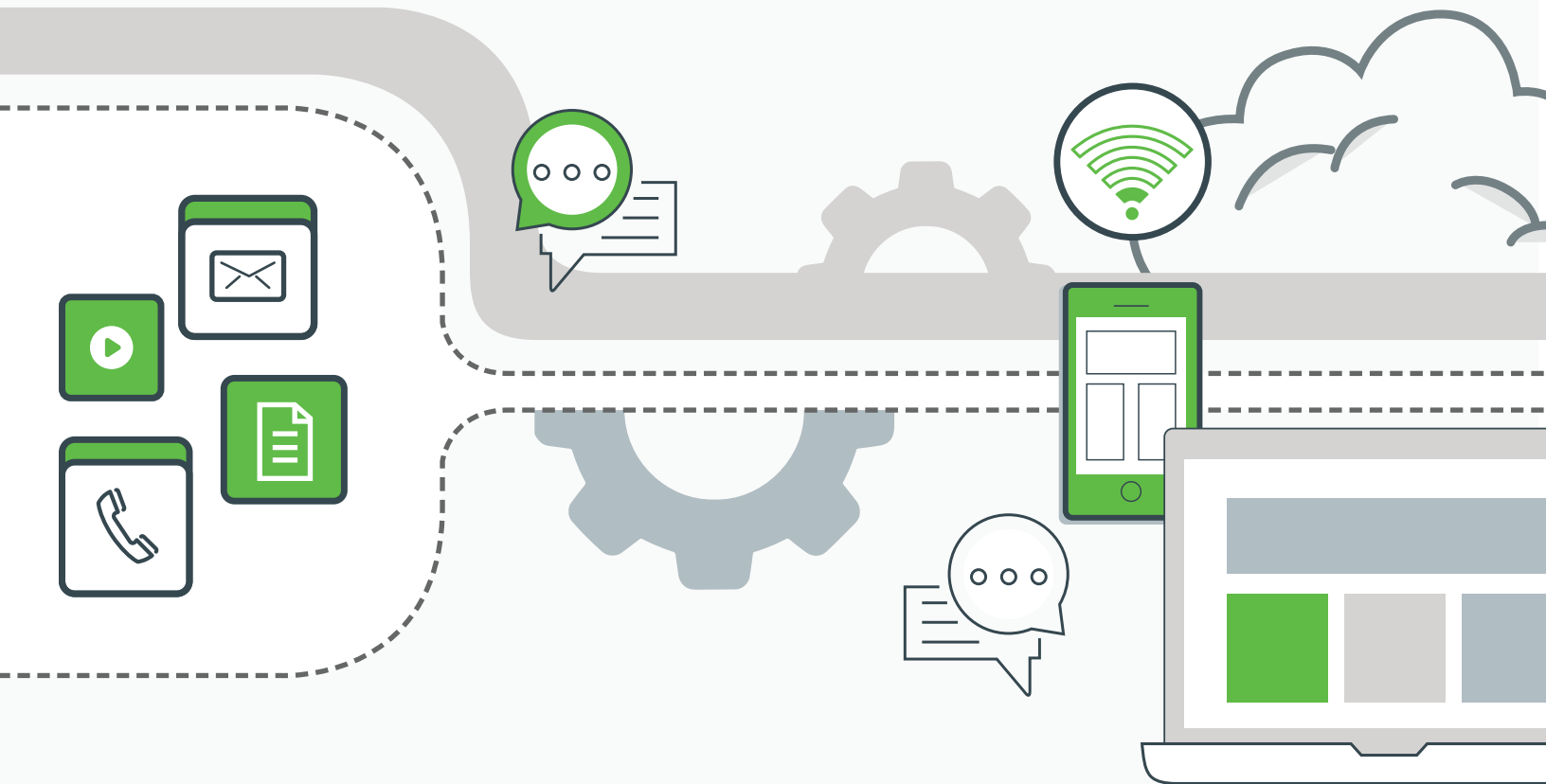
When you sign up for a 100mbps ISP modem service, you are not buying a dedicated 100mbps pathway all the way through your ISP's network for every minute of the day. That would mean it would be underutilized whenever you are sleeping or — gasp — doing something offline like reading a book. Instead, the ISPs oversubscribe their

network, using historic data to understand what the actual usage is across their subscribers so they can support that usage, without over purchasing their own connection to the internet. This allows them to provide cost effective, while still sufficient, plans for their clients.

There is not a straightforward formula for oversubscription, but it can be up to 100 to 1 (That is, the ISP sells 100 connections of 300mbps for every 300 megabits of their own connection to the internet). Normally, this keeps costs down and does not affect anyone's experience; however, it is not likely that the ISP budgeted for every house on your street to hold two home offices and a remote learning classroom.

What is a best effort network?





Making the Best Out of Best Effort Networks

The internet is a “best effort” network. It does not guarantee that a packet of data will get to its destination in a particular time frame – or even in the right order. When the oversubscribed lines get maxed out, its best effort might not be good enough for your business applications.

The result will be slowing or loss of packets at the bottlenecks. Best effort is usually fine for file downloads where a momentary bottleneck won’t even be noticed.

If it is more extensive, the internet may seem a little slower than normal or, if it is really bad, you may have to restart the download.

For a time-based application like a video conference, these traffic jams can create poor performance which is noticeable. When this happens with regularity, it is frustrating, difficult, and can disrupt key business operations.

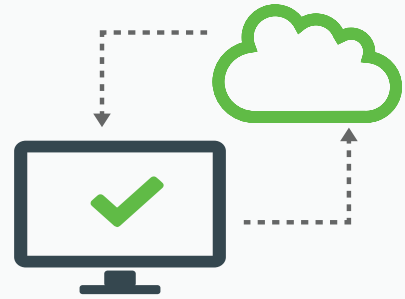
Do asymmetrical connections affect performance?

Since home internet use tends to be more about receiving data (such as watching videos and downloading applications) home internet is usually asymmetrical — that is, the download capacity is higher than the upload capacity. Fortunately, most business users will not bump into problems with asymmetrical connections unless they are regularly uploading large files or otherwise pushing a lot of data out.

So where is the problem?



Diagnosing Networking Issues for the Home Office



Some parts of the network are beyond our control, such as when oversubscription goes awry. Still there are a lot of things you can do to isolate and treat problems within these networks before calling the ISP.

Is it on the LAN or the WAN?

To start, determine whether the problem is in the **local area network** or actually with the **internet service**. This will help you narrow down whether you focus on issues within the home network or if you have to call the ISP.

One way to do this is by testing the network connectivity with the classic network diagnostic tool, **ping**, which can simultaneously ping the default gateway address (router) and a location on the internet. By looking at the traffic flow at two points, you can see whether the issues start inside or outside of the home.

Use the ping tool

To use ping, have the user **open a terminal** (AKA Command Prompt) on the computer:

How to open terminal

Mac

- Click the *magnifying glass* in the top right of the screen or press the *Command button + Spacebar*.
- The *Spotlight Search bar* appears. Type **terminal** and then press the *return* button.

Windows

- Click the *Windows* button and then type **CMD**.
- In the results, click *Command Prompt*.

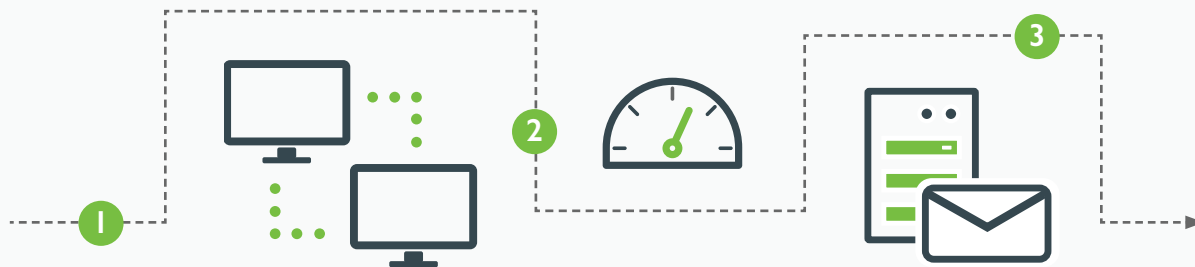
Determine the gateway or router. The quickest way is to type **tracert bigleaf.net** (or on a Mac **traceroute bigleaf.net**) and **press return**. The first address that appears is the LAN gateway.

```
tracert bigleaf.net — 124x50
Last login: Tue Apr 14 17:32:06 on console
The default interactive shell is now zsh.
To update your account to use zsh, please run `chsh -s /bin/zsh`.
For more details, please visit https://support.apple.com/kb/HT208050.
[The-Discerner:~ joel$ traceroute bigleaf.net
traceroute to bigleaf.net (23.185.0.3), 64 hops max, 52 byte packets
 1  modem.home (192.168.0.1)  3.766 ms  1.949 ms  1.433 ms
 2  ptld-dsl-gw52.ptld.qwest.net (207.225.84.52)  28.833 ms  32.917 ms  41.077 ms
 3  ptld-agw1.inet.qwest.net (207.225.86.153)  32.142 ms  32.185 ms  29.572 ms
 4  4.68.38.153 (4.68.38.153)  46.687 ms  40.569 ms  28.902 ms
```

The first IP mentioned in a traceroute is most likely the home router that will be pinged in the next step.

Continued...





Now, with two different terminal windows, start two pings.

WAN: a location on the internet, for instance Bigleaf's internet presence.
Type `ping bigleaf.net`

LAN: The Gateway IP
Type `ping 192.168.0.1`
or whatever the results from the tracer above.

Look at three things:

1. Is latency over 100 milliseconds on a regular basis?

If you are seeing regular results over 100 ms, you have found a problem that will affect video and other apps. Most networks should have a much lower average ping than that.

2. Are the two pings in sync?

- If there are problems on the LAN, the two pings will change in tandem. This shows that problems on the LAN are creating delays in the internet ping. Focus your troubleshooting on local problems.
- If the WAN ping is fluctuating, slow, or having timeouts but the LAN results are consistent and fast, the problem is on the WAN.

3. Is there a lot of variation from the mean (jitter)?

If the time varies a lot, with pings varying by 50ms from the mean, you are seeing jitter. Jitter creates a lot of challenges for real time services like video because packets get lost or arrive out of order.

For more detailed information on your network routes and health, we recommend using [PingPlotter](#).

When buying more bandwidth is worth it





Improving Business Application Performance on Home Networks

There are a number of things that can be done to improve your business application performance on your home networks.

Turn off all non-business-related applications

Stop all traffic on your network except those that are associated with your business applications. Get the kids to close their tablets and make sure there's no streaming video running on your TV or in the background of your computer while you run just your key business apps.

If this resolves the technical problem but creates problems among the people in the house, configuring the LAN quality of service (QoS) might allow all the uses to operate at the same time but prioritize the business applications.

Set up QoS on residential router

Some residential routers have a QoS feature. For network routing on the LAN, QoS allows the home user to manually adjust settings to priorities traffic by port or other signifier. Configured properly, it can identify and prioritize particular traffic, such as the Zoom meeting with the boss, over others, such as downloading the latest video game. It might be worthwhile to enable QoS. Be aware the **QoS features on the residential router only control LAN traffic in the house**, so they can't do anything about oversubscription or bottlenecks beyond the house. If the latency or jitter is beyond the gateway, this QoS will not resolve the problem.

Upgrade speed and capacity through ISP

ISPs have chosen to sell speed, so it is natural that consumers believe this is the only solution they have to solve their problems. However, many business applications don't actually require that much bandwidth to use. For example, Zoom only requires 2-3 Mbps, so a typical broadband connection should have more than enough capacity for a Zoom call.

Yes, getting a faster subscription might handle the different sources of your internet traffic better, but the additional capacity won't help if the internet connection is experiencing jitter, latency, or packet loss. The "bigger pipe" will cost more money but won't resolve the problem of making sure your business applications are prioritized.

Traffic prioritization across the WAN

An automated QoS solution that works from the LAN into the WAN is the best of both worlds. By optimizing the available bandwidth for important traffic not just in the LAN but to peered networks on the WAN, a residential SD-WAN solution can proactively make the best of what residential internet connectivity has to offer.





Prioritizing Work Applications on the Home Network

We are called upon to make our home internet connections as productive as possible. Optimizing the LAN and understanding our ISP can help, but it is hard to will into existence the business internet experience from the oversubscribed, over-extended internet connection that serves our neighborhoods.

Business Quality on Residential Connections

Bigleaf Home Office responds to the need for reliable and high performing work-from-home internet. Based on Bigleaf's SD-WAN technology for business sites, Bigleaf Home Office optimizes the traditional home Internet setup to auto-detect the needs of your business' applications and existing network conditions. Then it intelligently adapts traffic in real time to ensure uninterrupted uptime and continued productivity.

High Performance and High Reliability

Bigleaf Home Office connects to the Bigleaf owned-and-operated, fully redundant Cloud-Access Gateway Network. If you add a second circuit, Bigleaf Home Office automatically provides same-IP address failover and intelligent load balancing.

Enabling IT Support and Insight

With visibility and reporting, the IT team gets real-time and historical data from each home office internet connection, including web dashboards, performance reports, and email alerts. Bigleaf Home Office delivers the insights you need to support remote workers.

Learn More

To get more information on Bigleaf Home Office, visit

<https://bigleaf.net/bigleaf-home-office>
[#networkingfromhome](#)

