

## How to Forward Ports on Your Router

by YatriTrivedi on November 2nd, 2016



Although modern routers handle most functions automatically, some applications will require you to manually forward a port to that application or device. Fortunately, it's really simple to do if you know where to look.



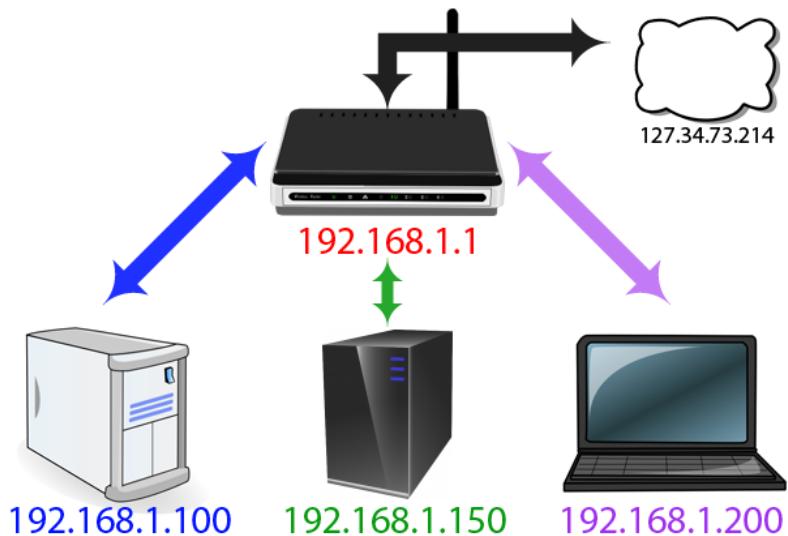
## What Is Port Forwarding?

There are plenty of projects we've covered that use your computer as a server for other devices. When you're inside of your network, most things will work fine. But some apps, if you want to access them when you're outside your network, make things significantly hairier. Let's start by taking a look at why that is.

## How Your Router Handles Requests and Uses Ports

Here's a map of a simple home network. The cloud icon represents the greater internet and your public, or forward-facing, Internet Protocol (IP) address. This IP address represents your entire household from the outside world—like a street address, in a way.

The red address 192.1.168.1 is the router address within your network. The additional addresses all belong to the computers seen at the bottom of the image. If your public IP address is like a street address, think of the internal IP addresses like apartment numbers for that street address.



The diagram raises an interesting question which you may not have thought about before. How does all the information from the internet get to the right device inside the network? If you visit [howtogeek.com](http://howtogeek.com) on your laptop how does it end up on your laptop and not your son's desktop if the public-facing IP address is the same for all devices?

This is thanks to a wonderful bit of routing magic known as a Network Address Translation (NAT). This function occurs at the router level where the NAT acts like a traffic cop, directing the flow of network traffic through the router so that a single public IP address can be shared among all the devices behind the router. Because of the NAT, everyone in your household can request web sites and other internet content simultaneously and it will all be delivered to the right device.

So where do ports come into this process? Ports are an old but useful holdover from the early days of network computing. Back in the day, when computers could only run one application at a time, all you had to do was point one computer at another computer on the network to connect them as they would be running the same application. Once computers became sophisticated to run multiple applications, early computer scientists had to wrestle with the issue of ensuring applications connected to the right applications. Thus, ports were born.

Some ports have specific applications which are standards throughout the computing industry. When you fetch a web page, for example, it uses port 80. The receiving computer's software knows that port 80 is used for serving http documents, so it listens there and responds accordingly. If you send an http request over a different port—say, 143—the web server won't recognize it because it's not listening there (although something else might be, like an IMAP email server which traditionally uses that port).

Other ports don't have pre-assigned uses, and you can use them for whatever you want. To avoid interfering with other standard-abiding applications, it's best to use larger numbers for these alternate configurations. Plex Media Server uses port 32400, for example, and Minecraft servers use 25565—both numbers that fall into this "fair game" territory.



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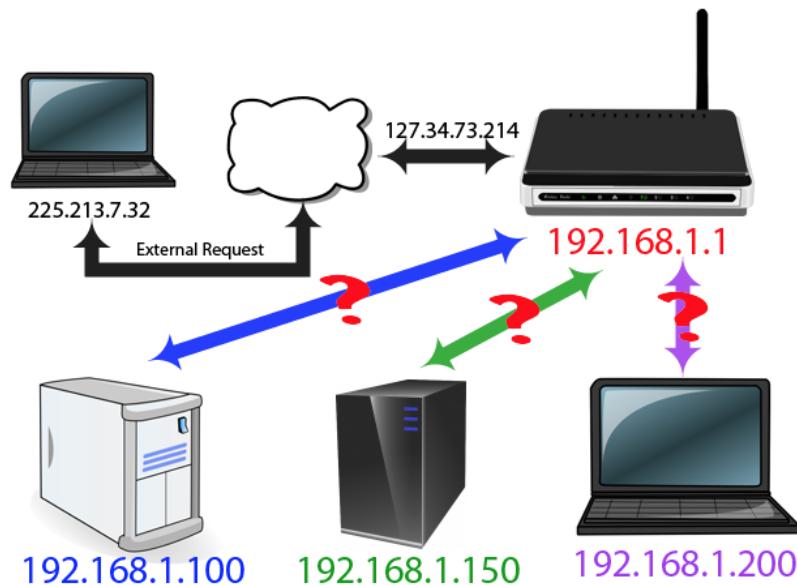
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Each port can be used via either TCP or UDP. TCP, or Transmission Control Protocol, is what's used most commonly. UDP, or User Datagram Protocol, is less widely used in home applications with one major exception: BitTorrent. Depending on what is listening, it'll be expecting requests to be made in either one or the other of these protocols.

### Why You Need to Forward Ports

So why exactly would you need to forward ports? While some applications take advantage of NAT to set their own ports and handle all the configuration for you, there are still plenty of applications that do not, and you'll need to give your router a helping hand when it comes to connecting services and applications.

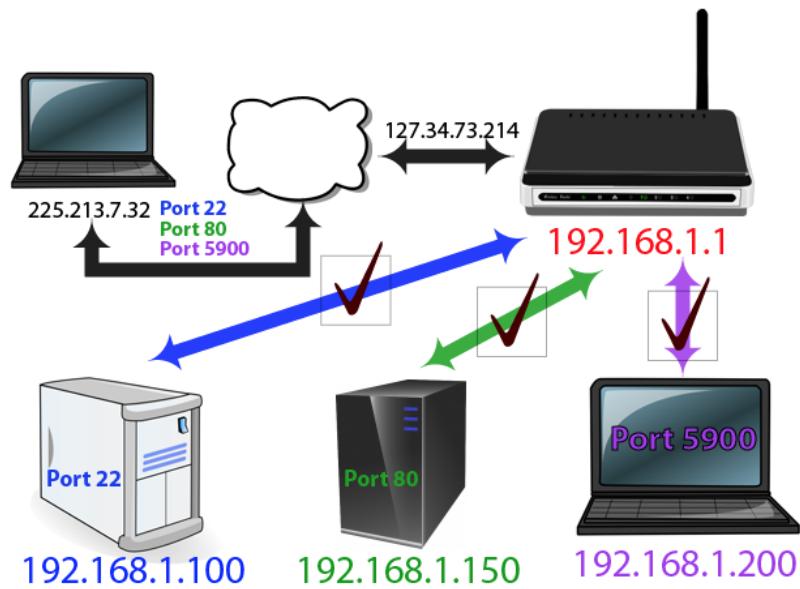
In the diagram below we're starting with a simple premise. You're on your laptop somewhere in the world (with an IP address of 225.213.7.42), and you want to connect to your home network to access some files. If you simply plug your home IP address (127.34.73.214) into whatever tool you're using (an FTP client or remote desktop application, for example), and that tool doesn't take advantage of those advanced router features we just mentioned, you're out of luck. It won't know where to send your request, and nothing will happen.



This, by the way, is a great security feature. If somebody connects to your home network and they aren't connected to a valid port, you want the connection to get rejected. That's the firewall element of your router doing its job: rejecting unwelcome requests. If the person knocking on your virtual door, however, is you, then the rejection isn't so welcome and we need to do a little tweaking.

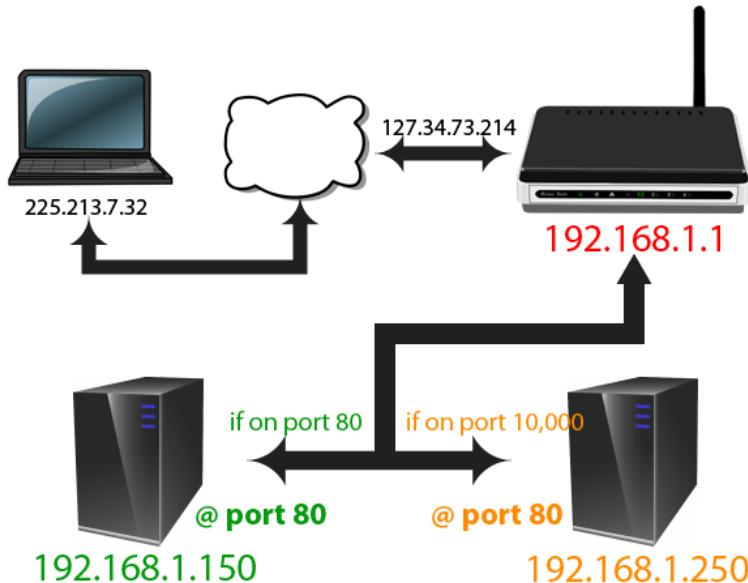
To solve that problem, you want to tell your router "hey: when I access you with this program, you'll need to send it to this device at this port". With those instructions in

place, your router will make sure you can access the right computer and application on your home network.



So in this example, when you're out and about and using your laptop, you use different ports to make your requests. When you access your home network's IP address using port 22, your router at home knows that this should go to 192.168.1.100 inside the network. Then, the SSH daemon on your Linux installation will respond. At the same time, you can make a request over port 80, which your router will send to the web server at 192.168.1.150. Or, you can try to remotely control your sister's laptop with VNC, and your router will connect you to your laptop at 192.168.1.200. In this way, you can easily connect to all the devices you've set up a port forward rule for.

The usefulness of port forwarding doesn't end there though! You can even use port forwarding to change existing services' port numbers for clarity and convenience. For example, let's say you have two web servers running on your home network and you want one to be readily and obviously accessible (e.g. it's a weather server you want people to be able to easily find) and the other web server is for a personal project.



When you access your home network from the public-facing port 80, you can tell your router to send it to port 80 on the weather server at 192.168.1.150, where it will be listening at port 80. But, you can tell your router that when you access it via port 10,000, that it should go to port 80 on your personal server, 192.168.1.250. This way, the second computer doesn't have to be reconfigured to use a different port, but you can still manage traffic effectively—and at the same time by leaving the first web server linked to port 80 you make it easier for people accessing your aforementioned weather server project.

Now that we know what port forwarding is and why we might want to use it, let's take a look at some small considerations regarding port forwarding before diving into actually configuring it.

## Considerations Before Configuring Your Router

There are a few things to keep in mind before sitting down to configure your router and running through them in advance is guaranteed to cut down on frustration.

### Set Static IP Address for Your Devices

First and foremost, all your port forwarding rules will fall apart if you're assigning them to devices with dynamic IP addresses assigned by your router's DHCP service. We dig into the details of what DHCP is in [this article on DHCP vs. static IP address assignments](#), but we'll give you the quick summary here.

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[How to Set Static IP Addresses On Your Router](#)



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Your router has a pool of addresses that it reserves just for handing out to devices as they join and leave the network. Think of it like getting a number at a diner when you arrive—your laptop joins, boom, it gets IP address 192.168.1.98. Your iPhone joins, boom, it gets address 192.168.1.99. If you take those devices offline for a period of time or the router is rebooted, then the whole IP address lottery happens all over again.

Under normal circumstances this is more than fine. Your iPhone doesn't care which internal IP address it has. But if you've created a port forwarding rule that says your game server is at a certain IP address and then the router gives it a new one, that rule won't work, and nobody will be able to connect to your game server. In order to avoid that, you need to assign a static IP address to each network device you're assigning a port forwarding rule to. The best way to do that is through your router—[check out this guide](#) for more info.

## Know Your IP Address (and Set a Dynamic DNS Address)

In addition to using static IP assignments for the relevant devices inside your network, you also want to be aware of your external IP address—you can find it by visiting [whatismyip.com](http://whatismyip.com) while on your home network. Although its possible you might have the same public IP address for months or even over a year, your public IP address can change (unless your internet service provider has explicitly given you a static public-facing IP address). In other words, you can't rely on typing in your numeric IP address into whatever remote tool you're using (and you can't rely on giving that IP address to a friend).

Now, while you could go through the hassle of manually checking that IP address each time you leave the house and intend to work away from home (or every time your friend is going to connect to your Minecraft server or the like), that's a big headache. Instead, we highly recommend you set up a Dynamic DNS service which will allow you to link your (changing) home IP address to a memorable address like `mysuperawesomesomeserver.dynu.net`. For more information how to set up a dynamic DNS service with your home network, check out [our full tutorial here](#).

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### **Pay Attention to Local Firewalls**

Once you set up the port forwarding on the router level, there is a possibility that you may need to tweak firewall rules on your computer too. For example, we've gotten a lot of emails over the years from frustrated parents setting up port forwarding so their kids can play Minecraft with their friends. In almost every case, the problem is that despite setting up the port forwarding rules on the router correctly, [somebody ignored the Windows firewall request](#) asking if it was OK if the Java platform (that runs Minecraft) could access the greater internet.

Be aware that on computers running local firewall and/or anti-virus software that includes firewall protection, you'll likely need to confirm the connection you've set up is okay.

## Step One: Locate the Port Forwarding Rules on Your Router

Exhausted by all the networking lessons? Don't worry, it's finally time to set it up—and now that you know the basics, it's pretty simple.

As much as we'd love to provide exact instructions for your exact router, the reality is that every router manufacturer has their own software, and how that software looks can even vary between router models. Rather than attempt to capture every variation, we'll highlight a few to give you an idea what the menu looks like and encourage you to look up the manual or online help files for your particular router to find the specifics.

In general, you're going to be looking for something called—you guessed it—"Port Forwarding". You may have to look through the different categories to find it, but if your router is any good, it should be there.

For comparison, here's what the port forwarding menu looks like on D-Link DIR-890L router:

And here's what the port forwarding menu looks like on the same router running the [popular third-party DD-WRT firmware](#):

As you can see, the complexity between the two views varies greatly, even on the same hardware. In addition, the location is completely different within the menus. As such it's most useful if you look up the exact instructions for your device using the manual or a search query.

Once you've located the menu it's time to set up the actual rule.

## Step Two: Create a Port Forwarding Rule

After learning all about port forwarding, setting up a dynamic DNS for your home IP address, and all the other work that went into this, the important step—creating the actual rule—is pretty much a walk in the park. In the port forwarding menu on our router, we're going to create two new port forwarding rules: one for the Subsonic music server and one for a new Minecraft server we just set up.

Despite the differences in location on different router software, the general input is the same. Almost universally, you'll name the port forwarding rule. It's best to simply name it what the server or service is and then append it if need be for clarity (e.g. "Webserver" or "Webserver-Weather" if there is more than one). Remember the TCP/UDP protocol we talked about at the beginning? You'll also need to specify TCP, UDP, or Both. Some people are very militant about finding out exactly what protocol every application and service uses and matching things up perfectly for security purposes. We'll be the first to admit that we're lazy in this regard and we almost always just pick "Both" to save time.

Some router firmware, including the more advanced DD-WRT we're using in the screenshot above, will allow you to specify a "Source" value which is list of IP addresses you're restricting the port forward to for security purposes. You can use this feature if you wish, but be forewarned it introduces a whole new host of headaches as it presumes that remote users (including you when you're away from home and friends who are connecting in) have static IP addresses.

Next you'll need to put in the external port. This is the port that will be open on the router and facing the internet. You can use any number you want here between 1 and 65353, but practically most of the lower numbers are taken up by standard services (like email and web servers) and many of the higher numbers are assigned to fairly common applications. With that in mind, we'd recommend picking a number above 5,000 and, to be extra safe, using Ctrl+F to search this [long list of TCP/UDP port numbers](#) to make sure you're not selecting a port that conflicts with an existing service you're already using.

Finally, put in the internal IP address of the device, the port you on that device, and (if

applicable) toggle the rule on. Don't forget to save the settings.

### Step Three: Test Your Port Forwarding Rule

The most obvious way to test if your port forward worked is to connect using the routine intended for the port (e.g. have your friend connect their Minecraft client to your home server), but that's not always an immediately available solution if you're not away from home.

Thankfully, there's a handy little port checker available online at [YouGetSignal.com](http://YouGetSignal.com). We can test to see if our Minecraft server port forward took simply by having the port tester try to connect to it. Plug in your IP address and the port number and click "Check".

You should receive a message, as seen above, like "Port X is open on [Your IP]". If the port is reported as closed, double check both the settings in the port forwarding menu on your router and your IP and port data in the tester.

It's a wee bit of a hassle to set up port forwarding, but as long as you assign a static IP address to the target device and set up a dynamic DNS server for your home IP address, it's a task you only need to visit once to enjoy hassle free access to your network in the future.

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**Jason Fitzpatrick** is a warranty-voiding DIYer who spends his days cracking opening cases and wrestling with code so you don't have to. If it can be modded, optimized, repurposed, or torn apart for fun he's interested (and probably already at the workbench taking it apart). You can follow him on Twitter if you'd like.

#### DID YOU KNOW

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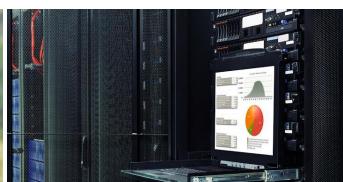


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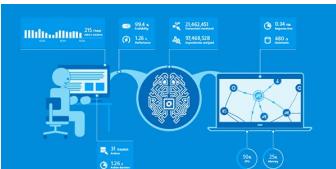
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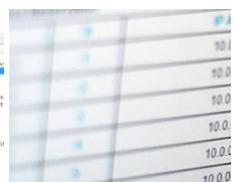
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