

# Networks







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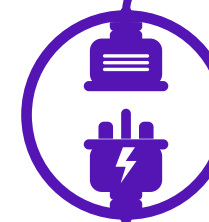
## Where does your Google search go?

Have you ever thought about how the internet works? Whether you're searching on Google, sending a message or scrolling through social media, it all seems to happen instantly. But what goes on in the background? How does the internet make it happen and is there more going on that we can't see?

Even if you're connected wirelessly to your home or school network, there are actually miles of cables connecting that network to other networks all over the world, and to lots of special bits of equipment called servers. These servers ensure your Google search goes to the right place to provide you with a result which is useful to you. When you do a Google search, you're actually sending a message to a network of equipment in a big building owned by Google, possibly in another country. Every time you search on Google you're actually sending data a really, really long way. It will travel through cables which are overhead, underground and even under water, connecting the whole planet and it's happening in under a second!

It's also why every website has its own unique address e.g. [www.google.com](http://www.google.com), which is actually a bit like a nickname. In actual fact every websites' real name is a bunch of numbers called an IP address (e.g. 127.0.0.1). Without a unique address we would never have reliable communications, as messages would get sent randomly to the wrong place instead of where they were meant to go.

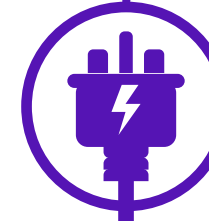
Just like how each phone has a unique phone number, and every email address is also unique, so are the IP addresses given to all the bits of equipment and all websites connected via the internet. Think of sending a message on an app as a digital way of sending a letter to somebody – by putting the correct address on the envelope, you ensure that even though the letter will get picked up and moved around by lots of people it will eventually reach the correct destination.



## Unplugged activities

If you'd like to have a go at an unplugged version of this activity, here's one to get you started:

- How do Search Engines work? A simple activity sheet outlines how search engines retrieve answers using real life examples - <https://tinyurl.com/bdzbfk8w>



## Plugged-in activities

If you'd like to have a go at a plugged-in version of this activity, there's lots that you can try:

- Network fundamentals – an interactive resource that teaches you the basics of networks - <https://tinyurl.com/38khruv>
- Networks - a virtual educational resource pack from the National Cyber Security Centre on network security - <https://tinyurl.com/3wh8bzhp>

Curriculum connections to the Internet and Networks from [teachcomputing.org](http://teachcomputing.org):

- KS1: Technology around us - <https://tinyurl.com/5fzrdn9v>
- KS1: IT around us - <https://tinyurl.com/ys9p9w4w>
- KS2: Connecting computers - <https://tinyurl.com/sj2hzse7>
- KS2: The Internet - <https://tinyurl.com/tuu56sae>
- KS3: Networks from semaphores to the Internet - <https://tinyurl.com/5h6zssrm>
- KS4: Networks - <https://tinyurl.com/nrt6swsp>



# Activity One

Let's have a go at building a basic network to bring that to life. In today's activity pack there are a selection of pictures ready for you to print and then cut out. These pictures are of common pieces of equipment that all connect together to form the internet. This includes your router which you connect your phone, computer, or games console to, the green cabinets in the street which your router connects to via copper or fibre cables and the equipment in the telephone exchanges.

Finally, there is a picture of a cloud, which believe it or not is part of our network too. The cloud represents the huge range of equipment that connect the internet's core – we use a picture of a cloud instead as you could never draw a diagram big enough to show how much equipment is involved! The cloud will sit at the centre of our internet model that we're about to build.

1. Cut out the print-outs from pages 5 & 6 to form labels for each component of your network.

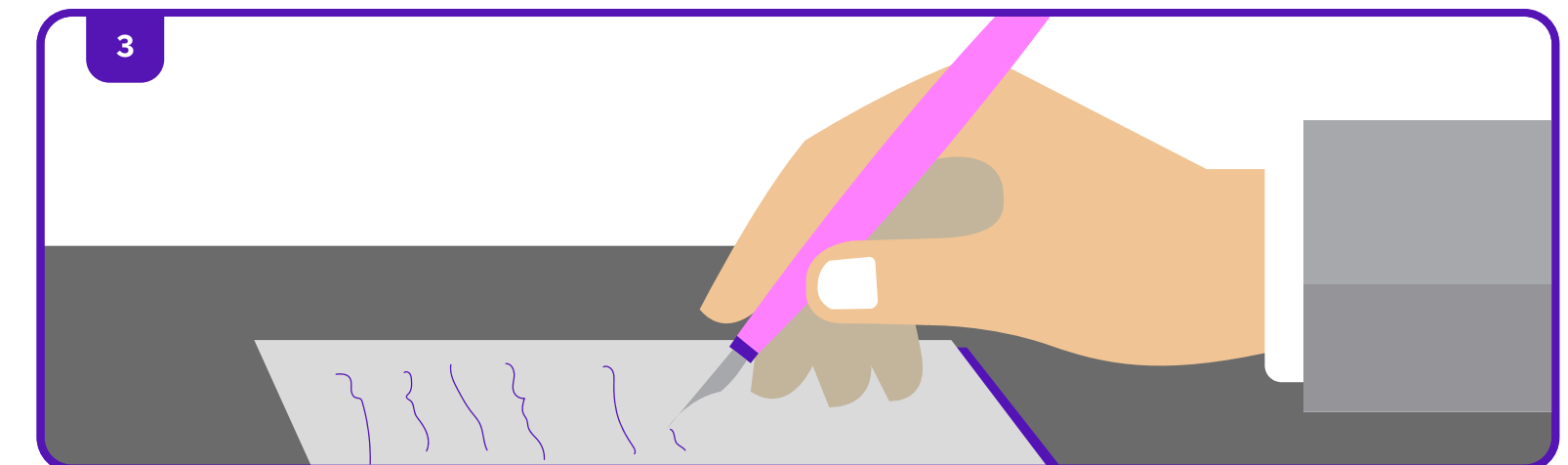
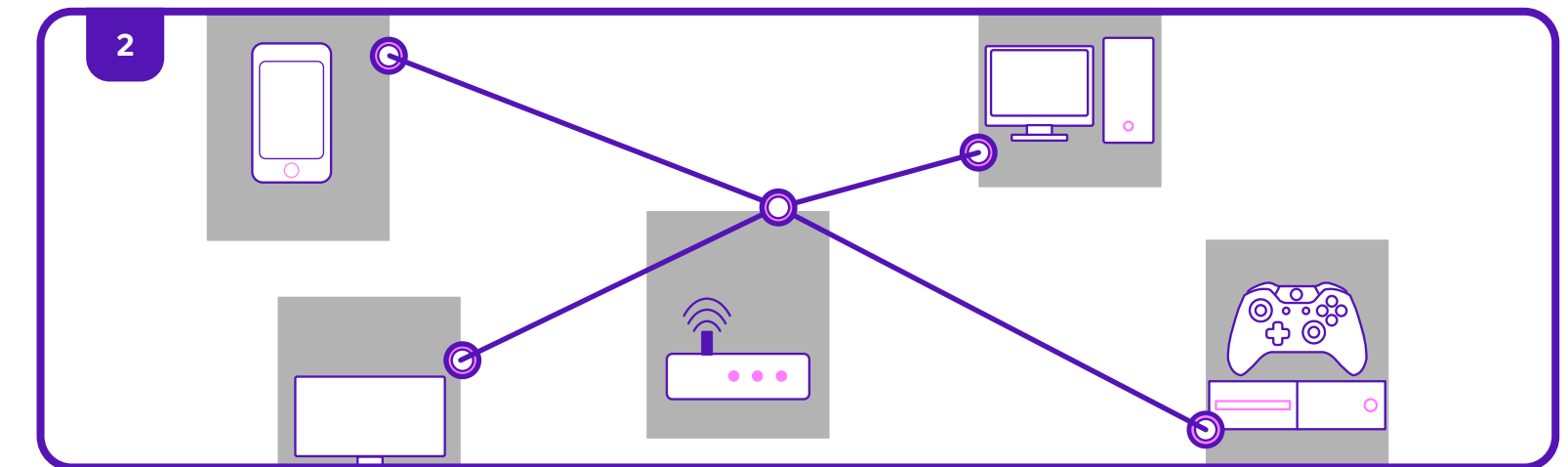
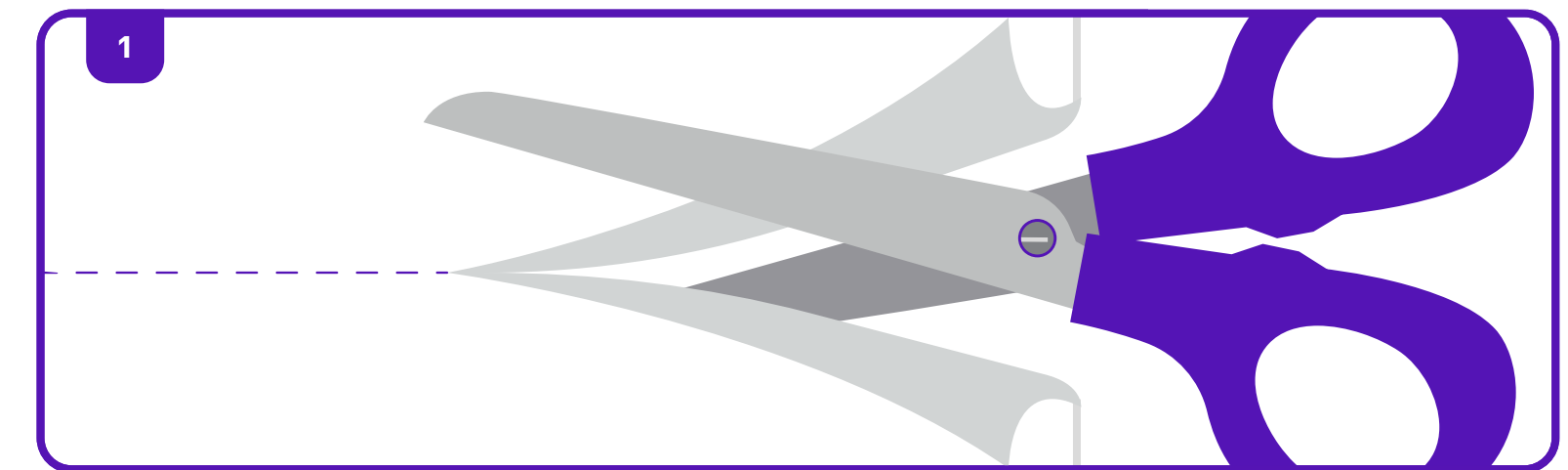
First off you should build your home network. You'll have cut out a router and various items which you typically find at home, but think about how each device connects. The central point of your home network is your router, and each internet-enabled device you attach will always connect back to that router, either over Wi-Fi or with a physical ethernet cable.

2. To represent this, we'll build a model with cups, string and our cut-out labels. On a table or on the floor, place a cup by each of the labelled items you think would sit in your home network. Using pieces of string, connect them all together to form your home network, with the router in the middle, connected to everything.

Now that your items are connected we'll look at how they communicate and send messages to each other – these will be very simple messages where the devices are telling each other their local name (IP address). This actually happens every few seconds on your home network.

3. Grab a pen and a piece of paper and write a short message that you want to send from one device to another. Put that message in an envelope and place it in the cup representing the sender's device (for example, the mobile phone).

Based on how we've just set the network up and connected all of our devices, how do you think you would send a message from the sender's device to another device on the same local network?



4. Move the envelope along the pieces of string and count how many devices (hops) your envelope needs to take in order to reach its intended destination. You should find that it's never just one hop, as everything needs to travel to the router to connect to anything else.

Now that we understand a basic home network, you need to connect it to the internet; this is where BT's infrastructure comes in.

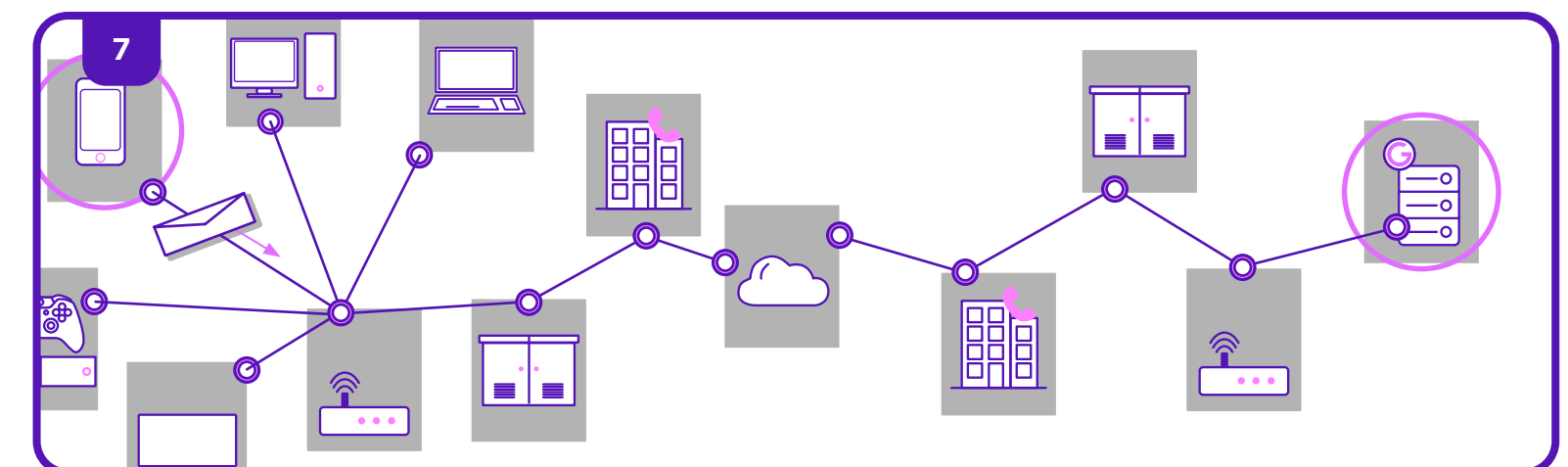
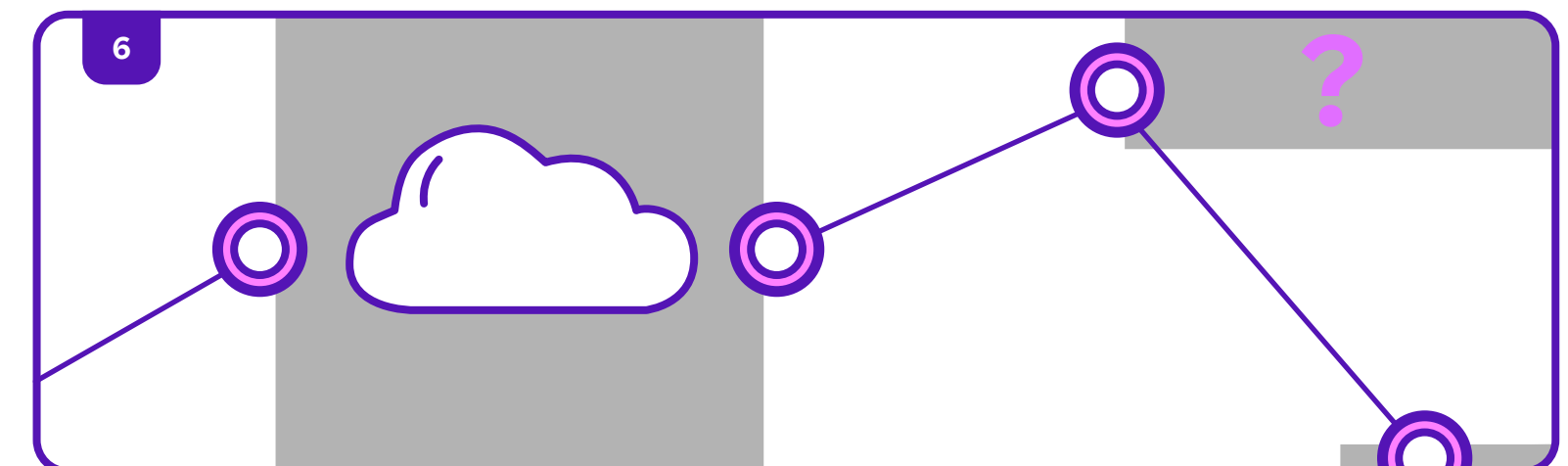
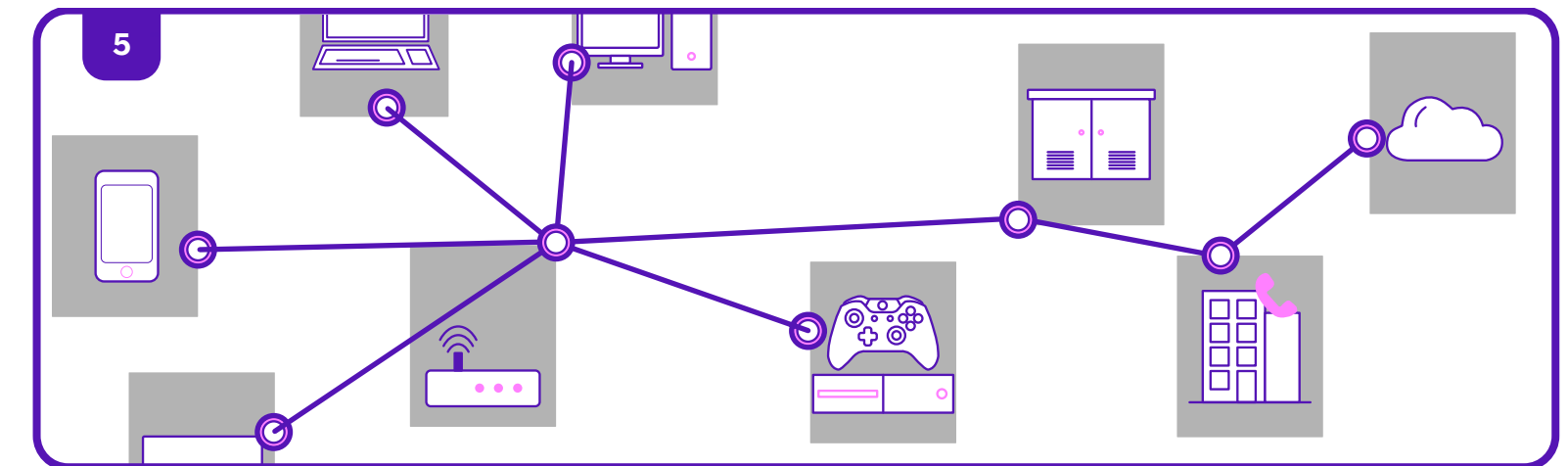
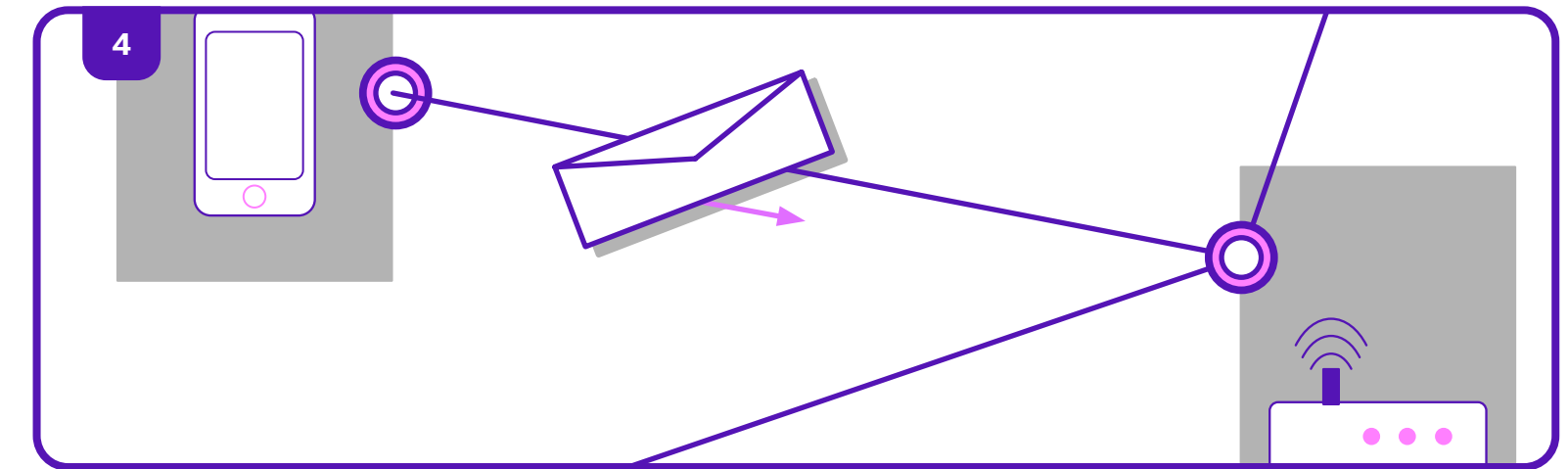
5. To your existing model, add in the green cabinet that your router connects to, followed by a telephone exchange, and finally the cloud which represents our core network.

Your home is now connected to the internet, but how would you access a website like Google?

6. On the other side of the cloud in your model, use your cups, labels, and string to represent how Google connects to the internet. Think about how you connected your home network in the earlier part of the activity, this should give you an idea of how this should look.

Once you've set up your internet model, you'll hopefully start to realise how complicated networks (and the internet) can become, and why it's important to give everything connected to it a unique name! For the next part of the activity, we want one device on your network to search for something on Google and then send it to another device on your network.

7. Using your paper and envelope to represent your search on Google, move the envelope across your model to help you figure out how many hops are needed just so your device can make that single search.



8. Once you've reached your destination for the Google search, move your envelope back along the route you think it would need to take to be sent back to you.

We've now got our search result back, but we then want to share it - how would we actually send it? Because we want to send a human-readable message, we need an app to send that Google search result to somebody else.

9. With the rest of your labels, cups, and string, add in the internet connection out to the app developer (for this activity we have used Microsoft Outlook as an example). This should mean that you now have another telephone exchange, connecting to another green cabinet connecting to another router for the Microsoft Outlook server - your internet model is expanding!

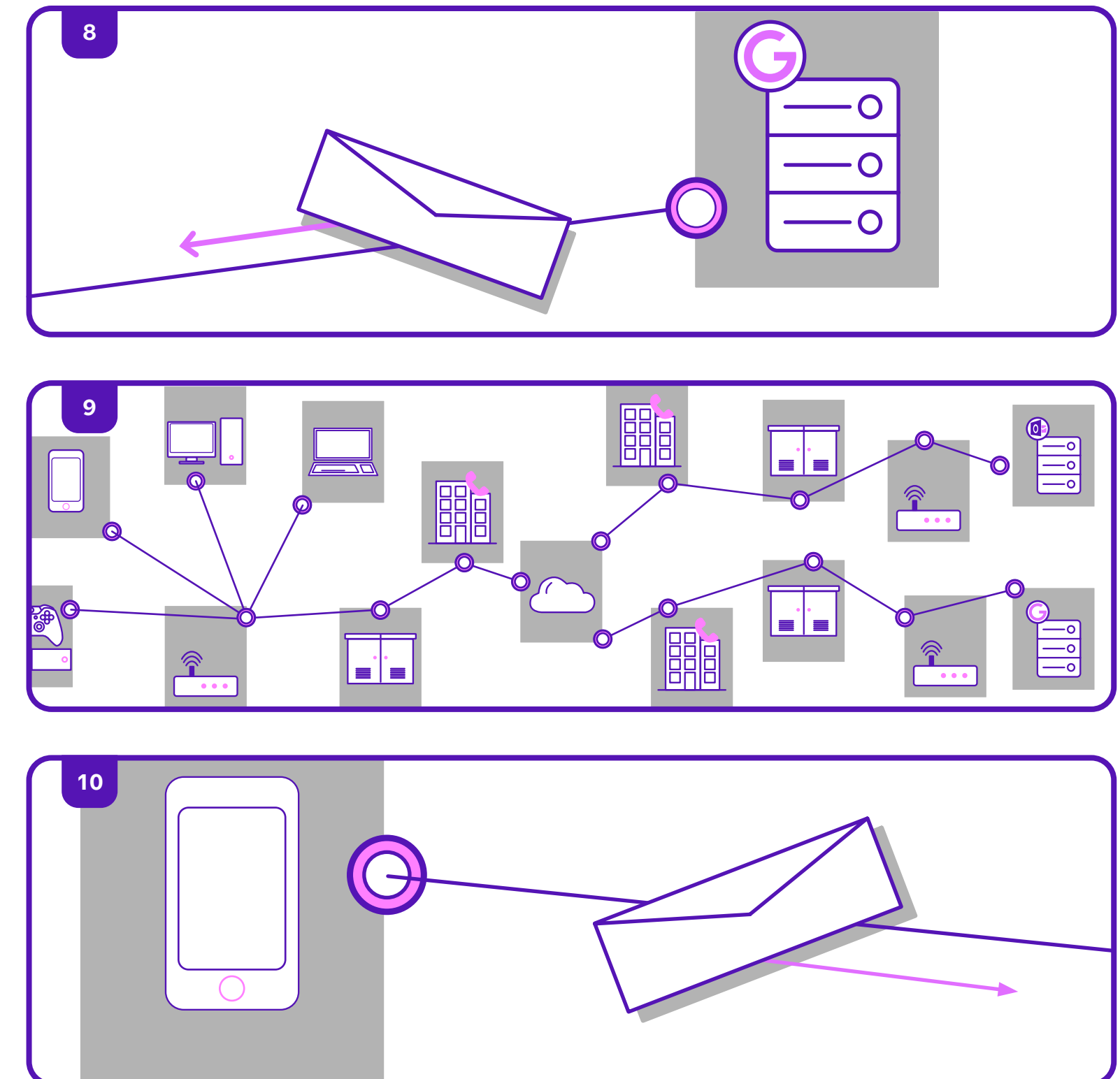
Now that we can carry out a web search using Google, and we have a company hosting an app which allows us to share the result of that web search, it's time to figure out how many devices our message needs to navigate in order to share that result with somebody else on our local network.

10. Start again from one of the devices on your home network in the model and figure out how many hops it takes to do a search on Google and send it to another device. This means making the envelope travel all the way to the Google server and back, and then all the way out to the Microsoft Outlook server and back into your local network to deliver the search result to someone else with a device connected on your local network.

This is just a simplified version of what goes on in the background every time you send a message, stream music or visit a website. Transactions like this are happening millions of times a second, right across the internet.

This activity is designed to help you understand a bit more about how networks work, and to appreciate the speed at which they work, but you can take it further... You could expand your model to include a friend or family member's home network or include other companies that host other applications.

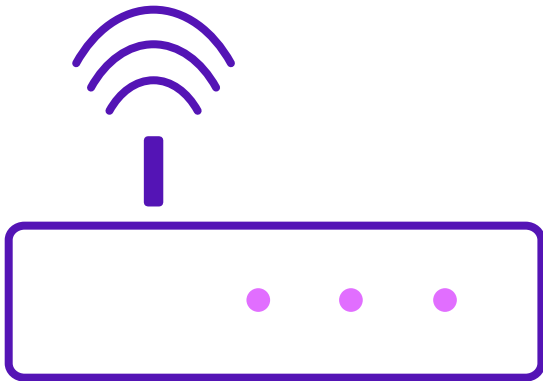
How big can you make your internet model? Do you have enough floor space to make a model of the network required for all of the apps you have on your mobile phone?



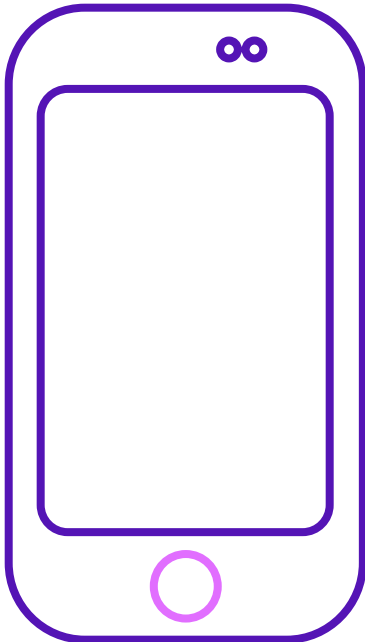
# Labels Page

Set 1

Networks



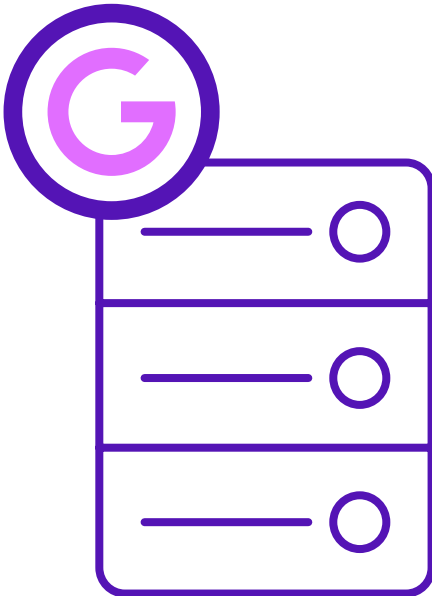
Router




Mobile phone



Telephone Exchange



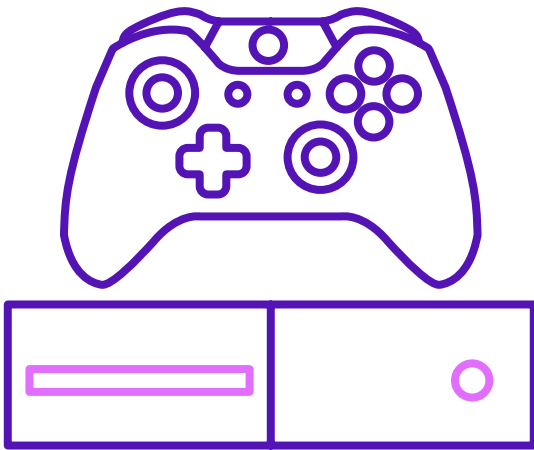
Google server



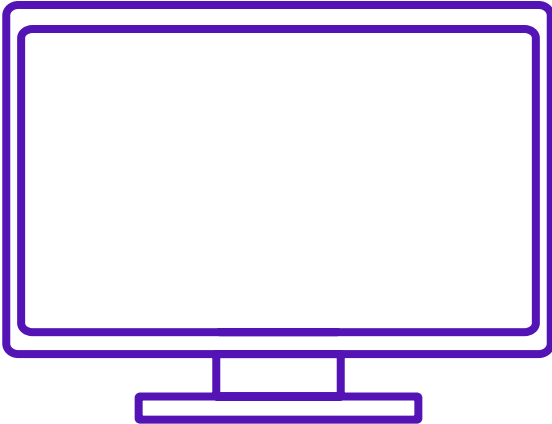
Computer



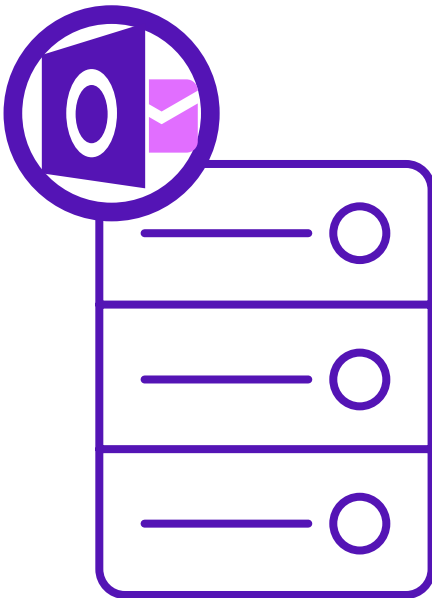
Router



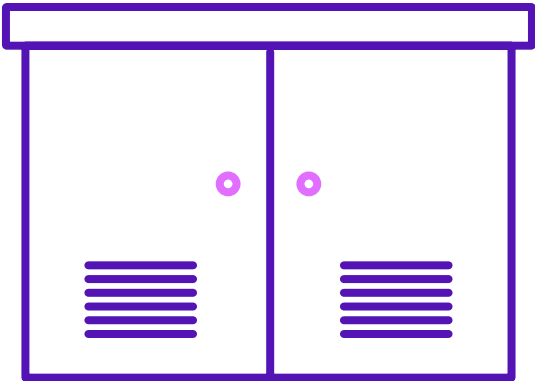
Games console



Television



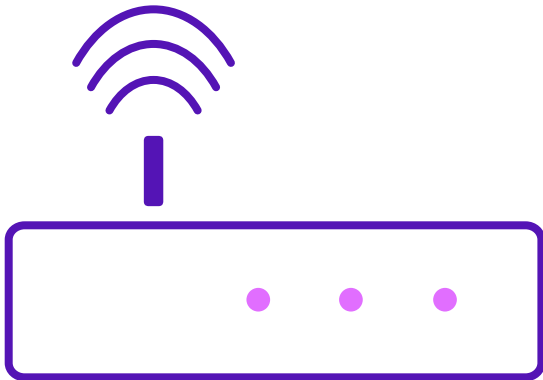
Outlook Server



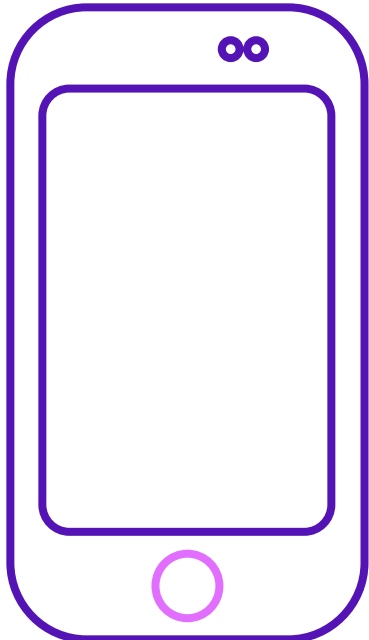
Green cabinet

# Labels Page

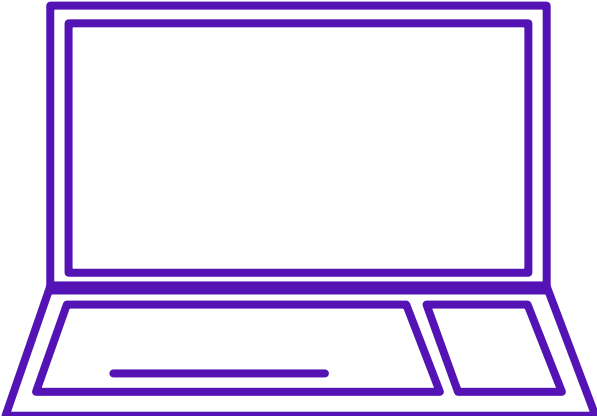
Set 2



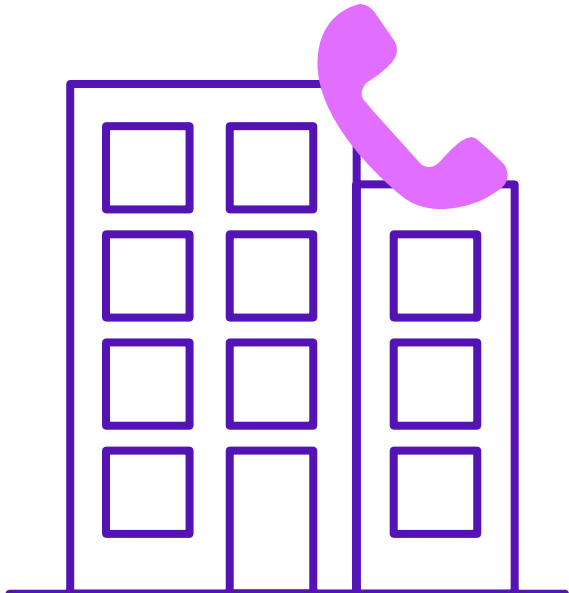
Router



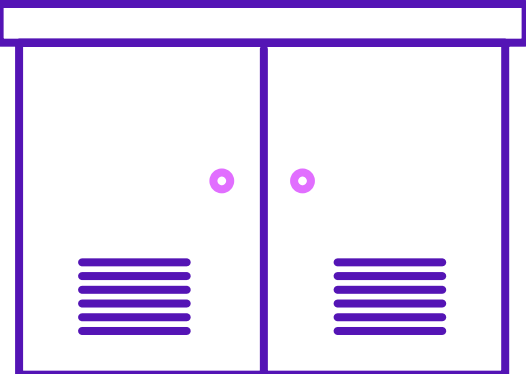
Mobile phone



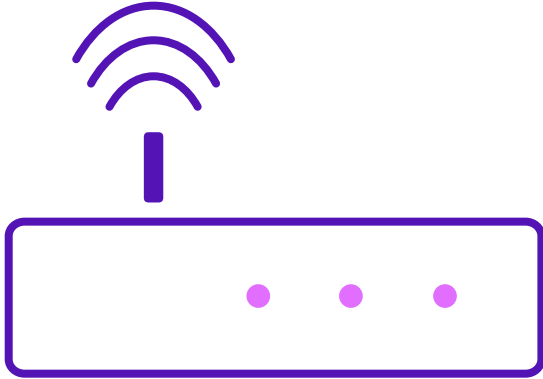
Laptop



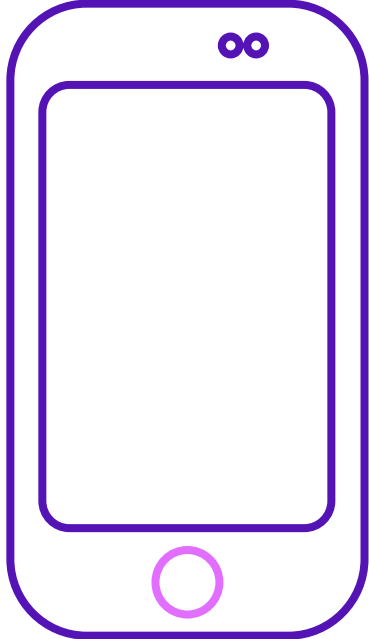
Telephone Exchange



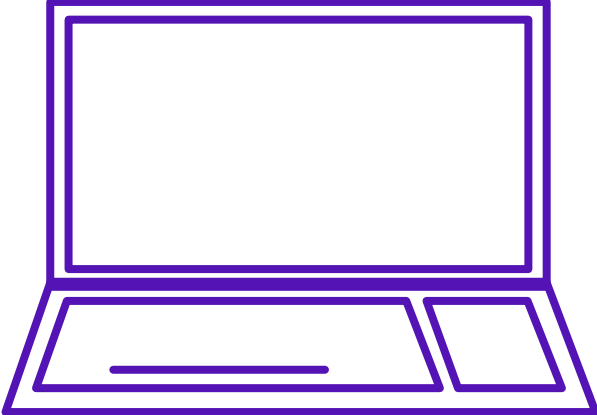
Green cabinet



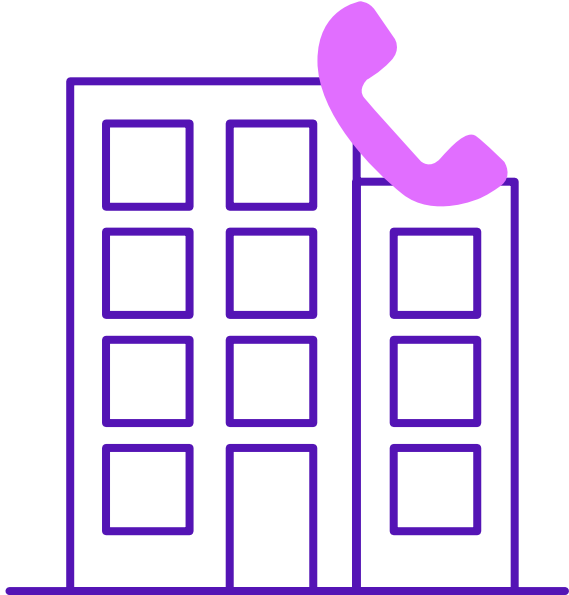
Router



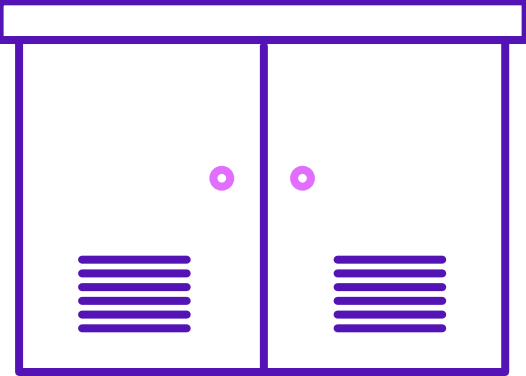
Mobile phone



Laptop



Telephone Exchange



Green cabinet