Train while you strain

What is a switch and what does it do?

At a primitive level, simple networks typically work with a number of clients (or computers) connecting to some sort of specialised network equipment like a router. We have discussed previously how the router usually houses a modem to talk to the outside world, and routes the traffic from outside to inside your home network, a conduit to the outside world really.

However when networks start to get bigger, rather than just a small home network, you may have 100 computers that need to get to the outside via. the router. It isn't viable to individually connect 100 different machines to the router, so what do you do? Well, intermediary mediums are required to manage all of the different connections, and this is where switches come in.

Try to think of a computer network as a mesh of many different roads, with the roads leading to and from all the possible destinations in the network. If more than one car reaches an intersection of roads at the same time, they have to wait for their turn to proceed. Now imagine the chaos that would ensue if there were 48 different roads all intersecting at the same single point – the waiting times for each car would be so high that everything would become unusable. A switch effectively provides an exit ramp for any one of those cars to get to any of the other roads as required, thus allowing traffic to flow freely.

This functionality is widely taken for granted by most non-technically minded people. For most people, you have a computer at your desk, you need it to be able to communicate with any other computer in the building, several printers, an email server, the outside world, and you just want it to work. The switches on the network enable all of this to happen in the blink of an eye. They are the unsung heroes of the networking world! How do they achieve this?

Each one of those computers and the router has a unique address assigned to it since the day of manufacture. This address is called a MAC address assigned to it at birth.

Whenever a device is connected to a switch, the switch stores the location of that device using the device's MAC address as the identifier. Every single device in the world that is designed to be networked, be it a phone, a computer, a printer, even modern central heating systems, will have a unique Media Access Control address, commonly referred to as a MAC address, assigned to it at the day of manufacture.

So strainee trainee, lets say your machine is connected to port 1 of a switch, the office printer is connected to port 10, the router is connected to port 20, and your colleague's machine is connected to port 30. The switch remembers which MAC address is connected to which port. So for instance if you need to print something, the switch automatically knows to facilitate communication between the MAC addresses connected to ports 1 and 10. If you need to get to the outside world, it knows to connect port 1 with port 20. And if your colleague needs to communicate with you, it knows to connect port 30 with port 1.

Clearly this is just a very tiny tip of a very huge iceberg. Over the years, switching technology has evolved and grown into an entire specialised field, with some switching networks reaching unfathomable sizes. In 2008 Cisco unveiled the Nexus 7000, which houses 512 ports. Some of the top tech firms actually design and build their own switches from scratch -- Google's Pluto switch is capable of delivering the speed of 40 million average home internet connections from a single device. Their switching requirements are so specific that the market simply doesn't cater for their needs, so they buy the microchips and raw materials, and build the devices themselves.