WHAT IS A DATA CENTER?

ALL ABOUT THE DIGITAL INFRASTRUCTURE INDUSTRY

WHAT IS DIGITAL INFRASTRUCTURE?

Most communication today is carried out digitally, for example, by email, mobile phone or streaming services like Netflix. This is known as **data communications.**

- Data is the information that is transferred
- Data communications is the means of sending or receiving data
- Network infrastructure is the cabling that the data travels through
- Data centers are the buildings where the data is stored

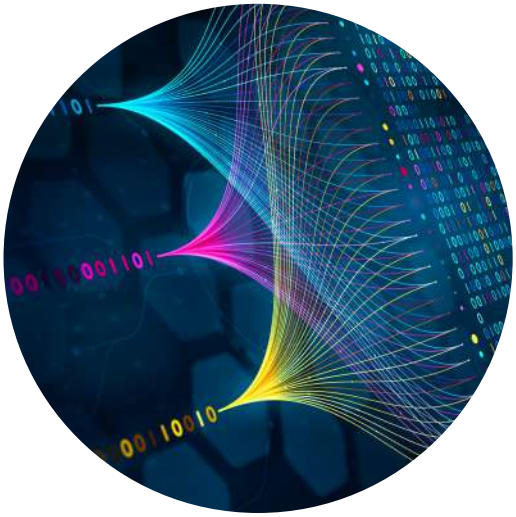
The term digital infrastructure includes both the place where data is stored, **a data center**, and the infrastructure that is needed to connect it all together so that we can use it, known as **network infrastructure.**

Together, data centers and network infrastructure support the world's digital activity and global connectivity by combining the physical resources that we need to allow us to use data on digital devices, such as computers, mobiles and games consoles.

Most people across the world use data on a daily basis, whether they're posting on social media, gaming, browsing the internet, using household technology, online banking or shopping, at work...the list goes on and on.

Digital infrastructure has become such an important part of our everyday life, we would find it very difficult to live without it.

Data is the information that is transferred



Data communications is the means of sending or receiving data

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WHAT HAPPENS IN AN INTERNET MINUTE?

A lot happens in 60 seconds on the internet...

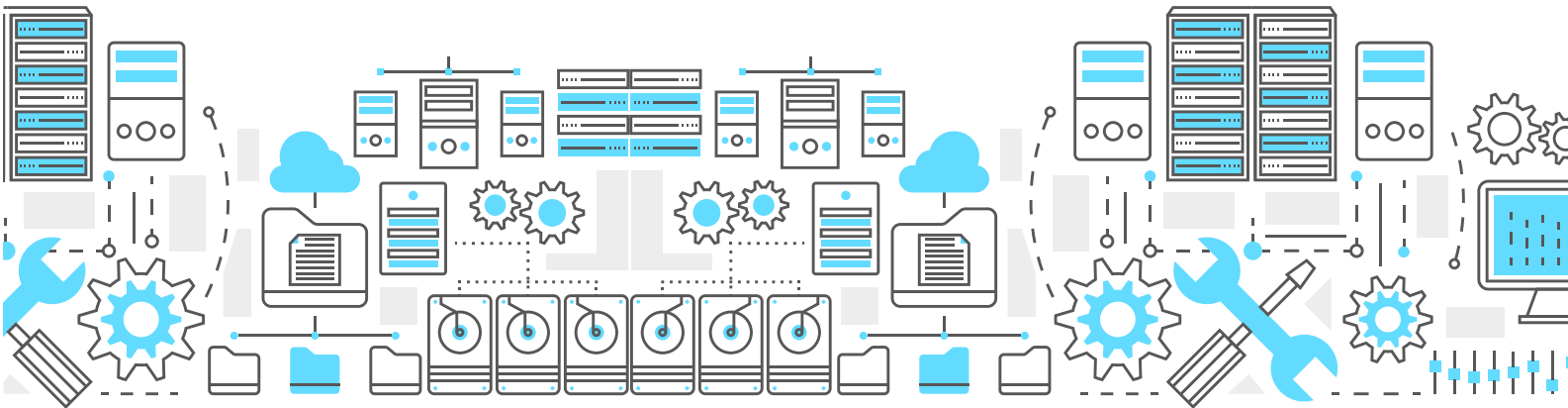
Data is being transferred constantly all across the world, so every time you check your phone, sit down to stream a film or listen to music, there are thousands, if not millions, of other people doing exactly the same thing!

In just one minute, 23 million kilowatt-hours (kWh) of electricity is used. Let's put that into perspective. If you have a 1,000 watt microwave, it takes 1,000 watts (or one kilowatt) to make it work. If you use the microwave for one hour, you'll have used one kilowatt of energy to power it for that hour, or one kWh. That means in just one minute, the internet uses the same amount of electricity that 23 million 1,000 watt microwaves would use in an hour. A kilowatt-hour is a unit of measurement of the amount of energy something uses over time. It's abbreviated as kWh.

In just one internet minute,
23 million kilowatt-hours (kWh)
of electricity is used.

That's the same as 23 million
microwaves on full power
for one hour!

BUT WHAT EXACTLY ARE DATA CENTERS AND HOW DOES NETWORK INFRASTRUCTURE CONNECT EVERYTHING TOGETHER?



WHAT IS A DATA CENTER?

A data center is a big, very secure building, with lots of powerful computers in it. These computers store and manage information, videos and websites that people want to keep safe, in the form of data. Every time you like a TikTok, browse Vinted or binge watch your favourite TV series, you are actually seeing information that is stored on a computer in a data center.

A data center is a building like no other. There are four components a data center needs to keep it operating: **power, cooling, connectivity and people.**

When you take a photo on your phone or send a message, you create a digital file made up of a sequence of characters or 'data'. You most likely store this data on your phone, but most of the time it is actually stored in 'the cloud'. Unlike the white clouds in the sky, this type of cloud is actually a data center – a physical building that could be anywhere around the world. The data will remain stored there, ready for when you want to view or share it, making it accessible whenever you need it.

Power

Data centers need a constant source of electricity. While the average house consumes around 11kWh of energy in a day, an average data center will consume 12,000kWh of energy per day. Data centers have more than one power source to make sure if one fails, there is another on standby to keep it running.

Cooling

Thousands of computers running continuously generates a lot of heat, so data centers need to be kept cool to make sure the computers do not overheat. This cooling can be done in a number of different ways, from air conditioning units to placing computers in cooling liquid baths! Lots of engineers and designers are working on clever ways to make use of the heat generated in data centers. One example of this is by redirecting the heat and using it to warm nearby homes or swimming pools.

Connectivity

To access the information held in a data center we need to be able to connect to it. This means a huge network of copper and fiber cables (network infrastructure) is used to enable data centers to connect with users and to connect to each other.

People

Data centers are packed with the latest technology but they still need people to design, build, maintain and operate them to make sure the data center continues to run 24 hours a day, 7 days a week, 365 days a year. In fact, technical staff are in demand in data centers across the world. Just like any other business, data centers also need:

- Administration
- Sales
- Marketing
- Accounts
- Human Resources
- IT
- Security
- Cleaners
- and more!

Kao Data's KLON-01 data center (Harlow) is home to the UK's fastest and most powerful supercomputer, NVIDIA's Cambridge-1. **Picture Credit: Kao Data**

DATA CENTER SUSTAINABILITY

With so much activity and so many devices accessing the internet and creating data, the power needed to run data centers keeps on increasing. More data centers are being built and more equipment is added to keep up with the demand, after all, we would not be happy if our phones stopped working or we couldn't communicate with our friends.

This demand for more data centers and equipment has led to an increase in energy usage and an increase in the carbon footprint of data centers (the total amount of greenhouse gases, including carbon, that is generated by the activity it undertakes), which is not good for the environment or for sustainability.

Sustainability is important for all of us, and the data center industry is taking steps to try and address the problem. A lot of the electricity used by data centers at the moment comes from a non-renewable source, such as coal or gas. However, data center operators are starting to choose renewable energy, made from resources that nature will replace, like wind, water and sunshine. Renewable energy is also called 'clean energy' or 'green power' because it doesn't pollute the air or the water.

In 2021, the Climate Neutral Data Center Pact (CNDCP) was set up to ask service providers and data center operators to voluntarily commit to a set of five important environmental goals.

Companies like Google, IBM and Intel have signed the pact and today, nearly 75% of Europe's data center capacity is covered by the renewable energy pledge.

WHAT IS NETWORK INFRASTRUCTURE?

This data that is stored within data centers is processed and made available to users across the internet. This happens at superfast speeds - a message can travel from London to New York in just 0.071 seconds. That's 50,000 miles per second! But how can this happen so quickly? It's all because of network infrastructure.

Imagine the data center as a brain where all the apps and data is stored, and the network infrastructure is the neurons, carrying messages from the brain (data center) to the muscles (the end user) and back.

In order for the brain and the muscles to communicate, they need to speak the same language and be connected. This is the same as when two devices, such as a computer server (in the data center) and your mobile, talk to each other:

- They have to speak the same language (the protocol)
- They have to be connected together through a communications path, which is known as a network

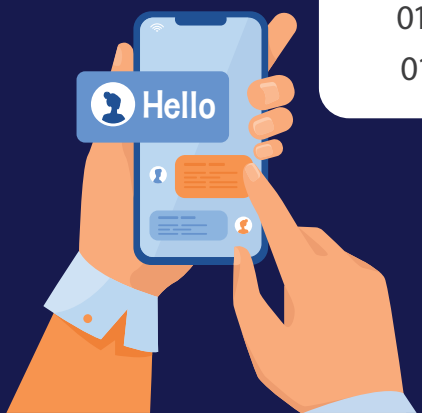
What Languages Do Devices Speak?

Computers only understand numbers. Knowing this makes it easier to understand how information gets from a 'sending device' to a 'receiving at' device.

Every key function on a keyboard has a numerical value which is then converted into a code. Computing systems use binary code to process digital information. Binary code is made up of just two numbers, 0 and 1. These two numbers are used in a string of eight binary digits (or Bits) in a row. They are used to represent 256 possible values which matches the 256 functional keys on a common keyboard.

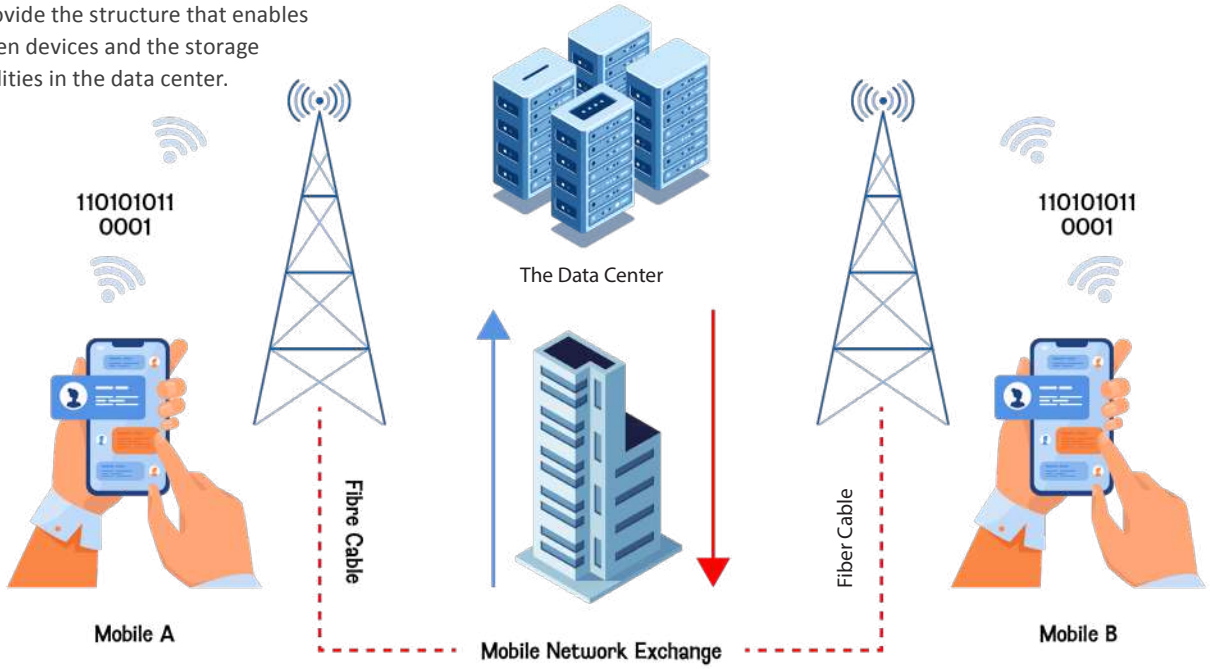
When a key is pressed on a keyboard, the associated string of eight Bits is transmitted. These strings of Bits become the code, or data, that is interpreted by the computer.

The word "Hello" in binary is: 01101000 01100101 01101100 01101100 01101111



The Data Journey

Cable Networks provide the structure that enables data to flow between devices and the storage and processing facilities in the data center.



HOW ARE DEVICES CONNECTED?

There are three ways of connecting devices together.
These connections are called transmission paths:

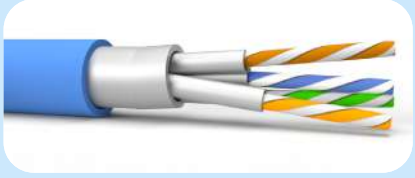
1. Copper cabling
2. Fiber optic cabling
3. Wireless connectivity

All three connections have design considerations with advantages and limitations. All connections have to consider what is being sent (the bandwidth), the distance between the sending and receiving devices, and the transceivers to connect the two devices.

A transceiver is an electronic device that can transmit (send) and receive data.

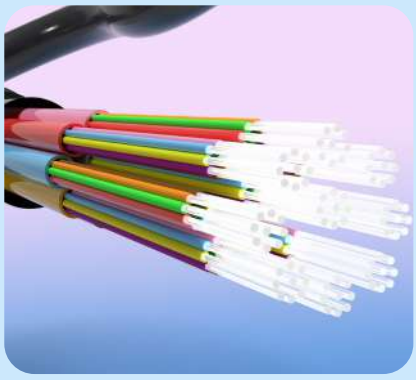
COPPER CABLING
Balance Twisted Pair

Copper cables are also known as balanced twisted pair cables. This is because each cable has four pairs of twisted wires inside the plastic exterior (the 'jacket'). Each pair of insulated cables is a different colour and has a different number of twists per inch. The twists help to eliminate interference from the other pairs of cables in the jacket and from other electrical devices. The thicker the wire and tighter the twisting, the higher the supported data rate (bandwidth).



FIBER OPTIC CABLING
Single-mode and Multi-mode

There are two types of fiber optic cabling in use today; single-mode (referring to information being transmitted through a single path of light), and multimode (referring to information being transmitted through multiple paths of light).



WIRELESS CONNECTIVITY
Using a Wireless Access Point (WAPs or APs)

Wi-Fi is a wireless networking technology that allows devices such as computers (laptops and desktops), mobile devices (smart phones and wearables), and other equipment (printers and video cameras, etc.) to connect to the internet without being physically connected via a cable.

Generally, wireless connectivity works via devices that create a wireless local area network (known as a LAN), which are then connected to the network using a wired connection via a copper balanced twisted pair cable.

WHERE IS NETWORK INFRASTRUCTURE USED?

Network infrastructure is needed in most buildings, from data centers, offices, airports, schools, colleges and universities, to roads and homes. Many new buildings are being designed to include structured network cabling as the 'fourth utility'. This means it is the next most important service after water, electricity and gas.

These new buildings are commonly known as Smart Buildings or Smart Homes. A Smart Building can include the following features:

- Connected equipment and building systems so you can be informed of what is happening in real time and access the historical records of what happened a few minutes, hours or days ago
- Building systems you can access remotely in case of an emergency
- Innovations that improve accessibility for the disabled, with automated door opening, fall detection, voice control, etc.
- Technologies that allow users to reduce the money spent on different supplies such as heating, light, water, etc.
- Automated systems such as lighting, power sockets, heating, air conditioning, appliances, doors, windows, blinds, etc.

How Do We Know it is Going to Work?

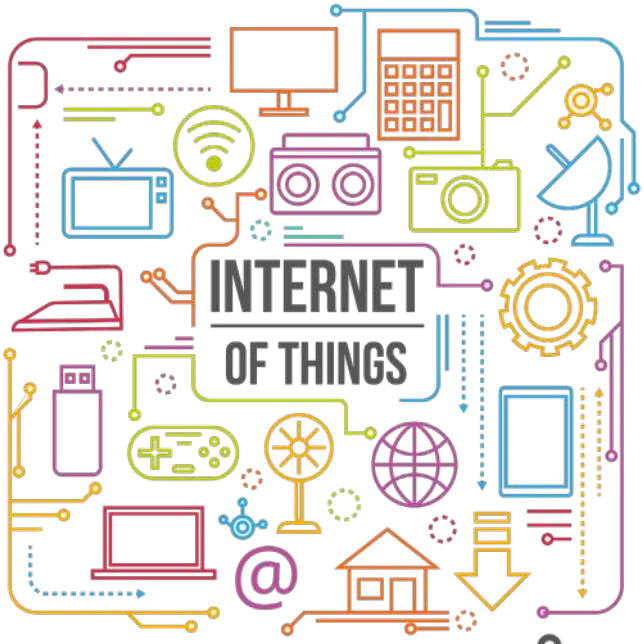
A set of guidelines, or industry standards, is issued to provide guidance on how to design, install and test a network cable installation. As long as these industry standards are followed, then we can guarantee that a network will work correctly.

A Note About Working Safely

When carrying out a cable installation, it is not only the activity you are doing, but also the location and duration of the task that will determine the level of risk. To reduce risk there are many different regulations that need to be complied with, that will also require additional training, such as:

- Health and Safety at Work Act 1974
- Confined Spaces Regulations 1997
- Working at Height Regulations 2005
- Control of Asbestos Regulations 2012
- Electricity at Work Regulations 1989
- New Roads and Street Works Act 1991

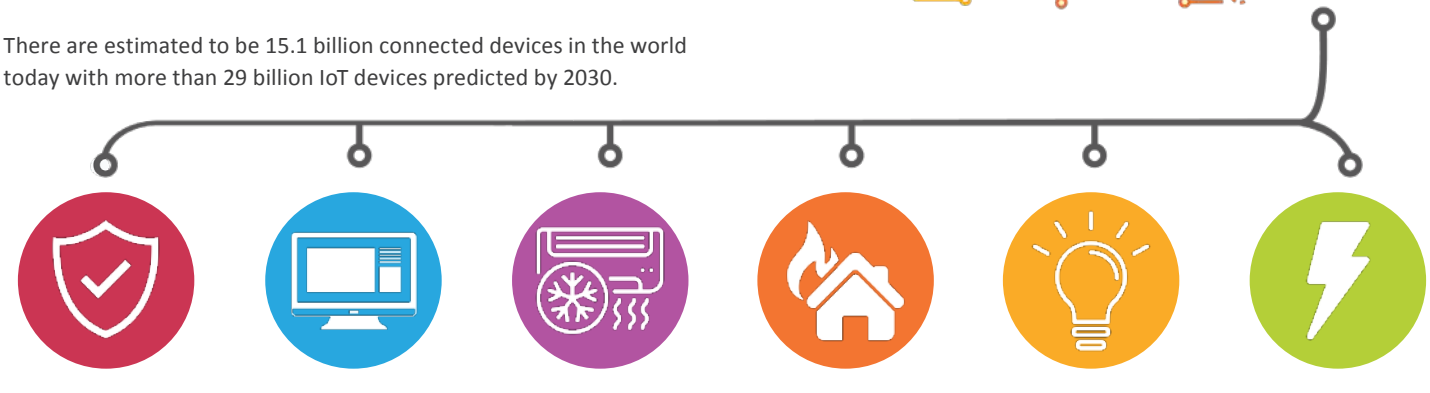
WHAT IS THE INTERNET OF THINGS?



The term Internet of Things (IoT) describes the network of devices that have a sensor, software, or other technology that connects them with other IoT devices and the internet, and exchanges data with them.

A thing in the IoT could be a lightbulb you switch on via your phone, a person with a heart monitor implant, your pet cat or dog with a microchip, a car with built-in sensors to alert the driver when tire pressure is low, or any other natural or man-made object that can be assigned an Internet Protocol (IP) address and is able to transfer data over a network.

There are estimated to be 15.1 billion connected devices in the world today with more than 29 billion IoT devices predicted by 2030.



SECURITY

24/7 MONITORING

HEATING, VENTILATION & AIR CONDITIONING

FIRE SAFETY

LIGHTING

ENERGY MANAGEMENT

CAREERS IN DIGITAL INFRASTRUCTURE

The digital infrastructure industry is an exciting and rewarding place to work. With competitive salaries, high job satisfaction and a wide range of job opportunities, the digital infrastructure industry has some really great career options.

Because the industry is relatively new and has grown quickly, many professionals currently working in data centers or digital infrastructure didn't set out to work in the industry. In fact, people have taken many different paths that have led them to a career in the data center industry…everything from a background in electrical work, IT, project management or even nuclear engineering! However, schools, colleges and businesses are working together to help young people learn about the industry and know what jobs are on offer.

More and more opportunities are becoming available to choose a career in the digital infrastructure industry, such as college courses that include cable installation in the curriculum or Apprenticeship openings with a company in the digital infrastructure industry.

WHAT JOBS ARE AVAILABLE?

Business Support

Supports the data center with necessary business needs such as finance, communication and analytics

Construction

Builds and manages the construction of new data centers and upgrades to existing facilities

Controls & Monitoring

Designs and maintains the systems that monitor and manage data center operations and equipment

Design

Plans the detailed technical design, construction and retrofitting of data centers, often with a focus on availability and efficiency

IT Hardware

Manages, installs, moves and maintains, and in some cases also designs, all IT equipment

Network & Connectivity

Connects all data center IT equipment, including between multiple data centers

Operations

Ensures the reliable operation of critical data center facility systems

Operations Engineering

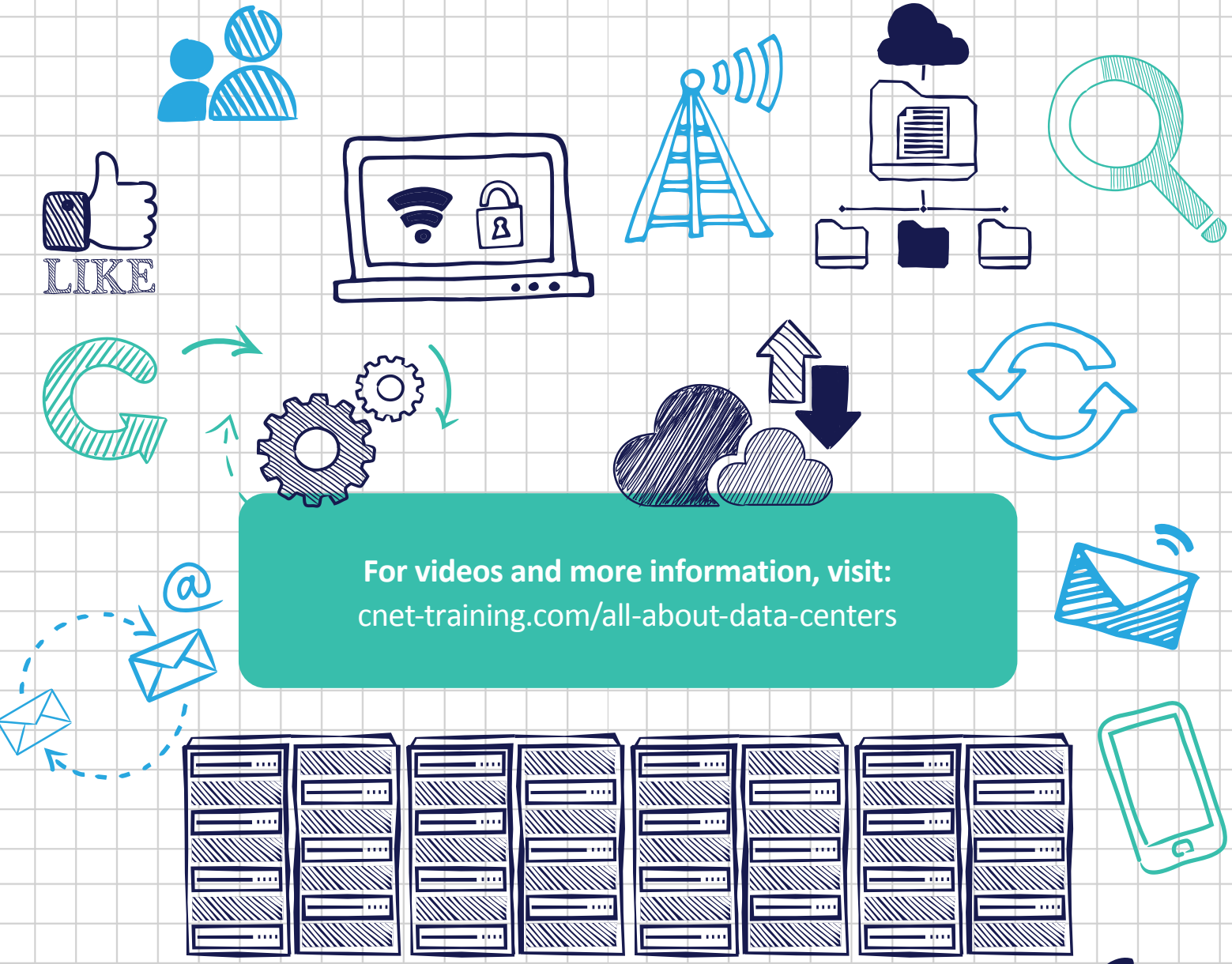
Plans, optimizes and oversees data centers' critical systems, often with a focus on availability and efficiency

Strategy

Guides the holistic planning, delivery and operational life of data centers

You can find out more about the roles within each of these areas using **Uptime Institute's Data Centre Career Pathfinder.** This is a free online tool that lists hundreds of career possibilities in the fast-growing global digital infrastructure industry. The Career Pathfinder is not a job site, it is a place to find information on more than 230 different types of job roles (based on typical real-world job roles) within the digital infrastructure industry.

For more information, visit:
https://datacenterpathfinder.com



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